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*Illustrated.

The Engineering and Mining Journal

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Lake Ores East and West

The rates charged for Lake Superior iron ore, while not fixed by general agreement as in previous seasons, seem to have been determined by some large sales made at figures which will probably be adopted by general consent. These are, f.o.b. Lake Erie docks, $3.75 per ton for Old Range bessemer and $3.50 for Mesabi bessemer ores; $3.05 for Old Range and $2.85 for Mesabi nonbessemers. The base for bessemer ores remains, as for several years past, 55% iron and not over 0.45 phosphorus; for nonbessemers, 51.5% iron. This is a reduction of 75c. per ton on bessemer and 65c. on nonbessemer ore. The actual reduction on the ore to the mining company is not so great as would appear, since there will be this season a decrease of 20c. in the freight from the Mesabi mines to the shipping docks. Moreover, the charters already made indicate a Lake carrying rate of 50c. from Duluth to Lake Erie ports, against 60c., which was the general contract rate last year. This means a difference of about 3c. only to the carrier, since the unloading charge—which is paid by the carrier—was 15c. last year, while it has now been cut to 8c. by the recent order of the Interstate Commerce commission. This does not, however, affect directly the seller of the ore; but taking the actual total difference in the freights, there is a reduction of 30c. The amount received for the ore at the Mesabi mine is less by 45c. on bessemer and 35c. on nonbessemer ores.

The season prices are no longer as important as they once were, since they affect not over 15 per cent. of the Lake ores. The rest are shipped to steel companies which own their own mines, and the ultimate price to them is the cost of mining and transportation, plus the royalty or other charge which represents the value of the ore in the ground. Several of the larger companies own their Lake carriers also; and the largest interest owns the rail carriers from the mines to the Lake, which has been one of the chief causes of complaint over the high freight rates heretofore charged. The same complaint is now being urged against the rates from Lake Erie to the chief furnace districts around Pittsburg and in the Mahoning and Shenango valleys. It is altogether probable that these rates will be reduced by the commission. The rates for carriage from the Lake Erie ports must be added to the price of the ore on dock to get its cost at the furnace.

Last year little Lake ore went to furnaces east of the Alleghenies, the needs of which were supplied by local ores and by imported ores, the latter being mainly from Newfoundland, Sweden and Spain. This year imports from Spain and Sweden are affected by the remarkable rise in ocean freights, which are now nearly double those charged early in 1911. Shipments from Newfoundland are not much affected as they are generally carried on long charters, or on boats controlled by the ore company. No great increase in Newfoundland shipments is possible at short notice, however. In view of these facts some sellers of Lake ore are making strong efforts to push their ores in the East. To that end they are said to have offered reductions of at least 25c. from the prices given above on Mesabi nonbessemers, which are the ores most in demand at the Eastern merchant furnaces. At the present time good local ores can be obtained at most stacks in the East at about 7¼@7¾c. per unit of iron, while imported ores are laid down, even with the higher freights at 7½c. at Philadelphia or Baltimore. Mesabi ores could hardly be delivered in Eastern Pennsylvania for less than 8.25c. per unit, even when the price is cut as stated above. We do not look, therefore, for much Lake ore to come East, unless business should be very active and an unexpected demand arise.

Production of pig iron has gone up again and is now at the rate of about 29,

500,000 tons a year. It may increase still more, but there is no probability of any shortage of iron ore. Eastern furnaces have their choice and can readily fill with Lake ore at a reasonable figure, if they find it necessary or advisable to do so later in the year.

The Guggenheims in Alaska

We have several times prophesied that a project to have the Government take over the Copper River railway would eventually materialize. The newspapers reported that Messrs D. and S. Guggenheim conferred with the President on this matter last Friday. We have no doubt, as we have also mentioned previously, that they would like to be relieved of their railway investment. The business has both serious and humorous aspects.

The Guggenheims and Morgans built a railway into Alaska, primarily to bring out the copper ore of the Bonanza mine, incidentally to develop the country, including the Bering coal field. The railway cost far more than was anticipated, the conservationists locked up the coal field, the railway has been operated under difficulties and now the builders would like to get their money back, with no prospective purchaser in sight except Uncle Sam.

This is different from the idea of the Guggenheims gobbling Alaska that has been worrying some of our lay contemporaries and some of the hayseeds in Congress. We wonder if the Guggenheims stirred up the whole business, making Mr. Pinchot an innocent catspaw, in order to lead up to the consummation now proposed?

If the Government should buy the Copper River railway for $20,000,000 and should saddle the charge upon Alaska, it would be a staggering blow to the mining industry of that territory. Yet we are not sure that the Guggenheims and Morgans are not entitled to some consideration at Washington. They invested their money in the development of Alaska, or a part of it, supposing that the Government was going to let it be developed in the old way. The Government, deferring to some foolish visionaries, stepped in and withdrew an important coal field, ousting some claimants thereto (who also appear to be entitled to redress).

The coal fields were heralded by the muck-raking magazines as being the locus of billions of treasure, but they turn out to be of but relatively small value, in fact of rather doubtful profit to any exploiter, although their coal would have been useful in the development of the territory if any one had been allowed to get any of it. The management of the whole business by the government has been a colossal bungle.

United States Smelting Co.

The report of the United States Smelting, Refining & Mining Co. allows some interesting deductions to be drawn concerning earnings of its properties. The ore produced from the company's own mines was 1,037,685 tons. The earnings of all companies without allowing depreciation, were $3,961,103, and after allowing for depreciation were $2,840,413. If the tonnage of company ore had yielded this profit, it would mean $2.74 per ton of ore.

Considering that the profits on the company's ore are those which ordinarily go to the miner, the smelter and the refiner, the margin of profit on either the company's or the custom ore must be rather small. That the amount of custom ore smelted is by no means inconsiderable, is shown by the fact that whereas the company ore (1,037,685 tons) carried the value of the metal contents in the proportion of 38% copper, 6% lead, 35% silver and 21% gold, the final figures of total production were: Copper, 21.48%; lead, 16.81%; silver, 42.72%, and gold, 18.99%. Of course, the smelting and refining profits on these custom ores must come out of the figures of profits, which, as said, points to one class of earnings being small indeed, and pointing again the moral that big corporations look to small profits on big tonnages.

The position of the minority stockholders in the subsidiaries has evidently been very interesting for the last three years. The outstanding minority stock and dividends are shown in the report. For the last three years these dividends have been respectively 0.66%, 0.08% and 0.03%, although in the last two years the growth of the portion of the surplus applicable to the subsidiaries' dividends has mounted to almost 9.8%. This points to an earning capacity of the subsidiaries on which minority stock is outstanding of about 5% per annum. This is, of course, an average figure, and some of the outstanding subsidiaries' stock has probably paid well. On the other hand, some must have paid nothing whatever.

A New Type of Gravity Plane

In this issue of the JOURNAL an interesting description of a self-acting gravity plane is published in which a device is used for throwing the short end of the haulage cable from one track of the incline up which an empty car has been hauled to the other track down which a loaded car is to descend. The brake drums and this device, a reversible guide sheave, are situated at the top of the incline, and the action of the last must be as fascinating to watch as its design is novel.

To those who are operating where the conditions are such as to permit a descending loaded car to haul up an empty one, this description will be of more than ordinary interest. It would seem that this device could easily be designed for use underground in stopes the floors of which are at too low a gradient for the ore to pass readily down to the haulage level.

It is worthy of more than passing notice that the author of the article presented in this issue, mentions a fault that developed in carrying out the original design of the first plane of this type that was installed; the fault arising from using a conical track-ring for the carrier of the guide sheave. Descriptions of the developments of faults in practice that could not be anticipated in plotting the designs are always instructive, but rarely are they described in print.

The fact that most large steel producers are running their mills up to 90 per cent. of capacity—which means practically full—shows that the trade is good, though it is not booming. The fact also that price advances from the lowest point have been small, and that no effort is being made to push them up further, shows that the situation is appreciated by the large producers as one that depends largely upon the incentive of cheapness.

By The Way

Sir Moreton Frewen, who is an expert on the silver question, anticipates that the drain of gold to India at the present time threatens the most serious consequences in the money markets of the western world. This ought, however, to be comforting to those economists who have seen in the increased supply of gold, the cause of high prices during the last decade. At the same time, the report that the Chinese Ministry of Finance contemplates the immediate issue of 30,000,000 silver dollars ought to gladden the hearts of the friends of silver.

Original, or "makeshift," methods of doing things can be seen and heard almost every day in the copper mines of upper Michigan. William was up in the stope at a freshly broken face, from which place he called to Tom, standing on the level, "Tom, ist there?"—"Ase, ase wat do 'ee want?"—"Go up to and fe'ch down bit stull"—"'Ow long of a stull do 'ee want?"—"A midlin' long un"—"Can't 'ee measure 'im?"—William measured in his own fashion and called back, "Tom, the bit stull I want 'ee dha measure is long as a pick an' a pick 'andle, a gad an' a gad 'andle, taw bluddy wedges an' a big flat rock."

A brisk advance in Quicksilver shares, on Apr. 9, interested antiquarians, says the *Sun*. The company is one of the oldest, if not the oldest, mining company with stock listed on the Stock Exchange. It was incorporated in 1866 and for several years paid handsome dividends. The par value is $100 and in the old days the stock sold at or above par. Daniel Drew is said to have made enough money out of it to found the Drew Theological Seminary. No dividend has been paid on the common since 1882 and none on the preferred since 1903. Latterly the quotations have ranged around 5 for both the common and the preferred. The advance on Apr. 9 carried the common to 6⅞ and the preferred to 6⅛.

Many things in mining and metallurgy look easier to do than they really are; the same is true in publishing. About six months ago, the coal-mining department of the JOURNAL was discontinued, and the publication of a technical paper, devoted to the field of coal mining, was undertaken, under the direction of F. W. Parsons, who formerly had charge of the JOURNAL'S coal department. *Coal Age* has achieved a rapid and enviable success, and already has over 6000 paid subscribers, and we don't know how many readers—as the enterprising advertising solicitor would say. It might have more readers, as the accompanying letter indicates: "I am subscriber for your magazine and asking for some information. I want to know if you can print *Coal Age* in the Hungearing language. If so, it means an nother subscriber for you, as I have a Hungearn friend who wishes to read it." We fear, however, that Mohammed will have to be moved to the mountain.

There are exceptions to the endings of the stories of the "sucker" and his "investments" in mining stocks as such tales are generally related. Here is one that a correspondent has forwarded: Back in the late '90's the postmaster at Cripple Creek received a "squawk" letter from a crossroad hamlet in Iowa in which the writer berated his own folly in parting with $2000 of his good money for a mining stock and after exhausting all the proper expletives which the subject warranted asked to know if there was any such company as that, the name of which was engraved on his green certificates and if there was any chance of getting his money back or any part of it. He had paid 10c. per share and knew he was a fool to do so. The company inquired of was the great Portland, which in the interval of the "victim's" investment and the writing of the letter had paid three dividends and the stock of which was then selling at $2.60 per share. By error in the address on the company's records the stockholder had not been officially informed of the affairs of the company and his state of mind on receiving the reply with the facts can be well imagined.

In investigating an *antigua* in South America, Alexander P. Rogers, of New York, last year made a long journey into the interior, going up the Amazon to its sources, through the Riberao rapids, across the stretch of jungle from the Guapore River to the Paraguay, thence to Buenos Aires. In *World's Work* for April, he has described this interesting trip of 5500 miles, all but 180 of which were traveled in boats. In investigating the gold fields near Matto Grosso, he found proof that the same regions had been explored 150 years ago by a band of adventurous gold seekers. They were remarkably successful in their search for gold, too, and found every mine which is known today in that region. At a mine near Matto Grosso they brought in a small army of slaves and cleared off the jungle for a mile around, while others were set to work constructing a long ditch to bring water to the flat below. It was a clever piece of work for men without surveyor's instruments. They cut the ditch through a cement formation, that in places was 20 ft. in depth, and near the lower end they constructed a great chamber in which they ground the ore between huge rocks. Whether they used mercury to amalgamate the gold could not be determined, but several stone tanks and sluices indicated that possibly they did. They built a town around these works with a brick kiln and a distillery as the most important adjuncts. It must have been a busy and exciting place to live in, ruled over by an iron hand, the master's word law in everything, and a cruel law it was. They took out a large amount of gold. And then to enjoy it, they had to get out to the civilized world with it, through 3000 miles of hostile country, where free-booters lay in wait.

It's hard to keep a good fake down. Out of Darkest Arkansas comes an inquiry for a good, reliable "Spanish needle" for locating gold and silver. It's no use spoiling a thing in the telling, so we offer it in the original orthography and typographical style of the Arkansas hinterland: "April 3+4, 12—To the ENGINEERING AND MINING JOURNAL: I Will Drop you a few lines to see Wheather or not you all handle eny Spanash Needles en your line of Goods iff you Doe Please Send me your Price list on them and your Best Turms and I Want one that a man Can Depend on. I Want one that will loe cate Silver or Gold and iff your house Don't handle the Goods Would you Bee able to Give me the name of some furm that Does. Well I Will Remain as ever yours truly ——— ——— By By hoping to here from Soone and a Good Reply." We chronicled, in the JOURNAL of Feb. 4, 1911, the interference of the postal authorities with the Stauffers' thriving mail-order business in "goldometers," "electrometers," and "Spanish needles." We have not since heard of any new school giving "short courses" in gold finding, though it is quite possible that the former vendors have paid their fines and resumed business.

If we consider the current prices for chemical analyses, one is prone to think that in one field, at least, competition has had full play, says H. P. Talbot, in *Science*. It were, of course, rank heresy in this good city to suggest restraint, and yet it seems full time that something should be done, lest the day might come when the chemist would have to pay the manufacturer for the privilege of making analyses for him. How can an analytical chemist hope to maintain his professional standing when his charges for individual analysis—even when done in quantity—are such that, unless he is to count his own time as without value (and sometimes even under such an assumption), he can not possibly do reliable work without an actual financial loss? I do not wish to draw any unpleasant or unfair inferences as to which horn of such a dilemma the commercial analytical chemists choose; for the most of them are, no doubt, trying to make the best of a difficult situation. Unfortunately, I have no specific remedy to propose, but it is all too evident that these conditions tend to belittle this branch of our science, to result in a large output of inferior work, and to create a distrust which spreads unduly.

Copper Production of the World

Messrs. Henry R. Merton & Co., of London, have completed and issued their estimate of the copper production of the world; the figures being given in the table herewith in long tons:

COPPER PRODUCTION OF THE WORLD

In Long Tons

	1910	1911	Changes
United States	484,935	492,650	I. 7,715
Mexico	61,515	54,030	D. 7,485
Canada	25,715	24,930	D. 785
Newfoundland	1,080	1,155	I. 75
Cuba	3,475	4,455	I. 980
Total North Amer-	576,720	577,220	I. 500
Argentina	300	1,020	I. 720
Bolivia	2,500	1,800	D. 700
Chile	35,235	29,595	D. 5,640
Peru	18,305	25,445	I. 7,140
Total S. America	56,340	57,860	I. 1,520
Austria	2,130	2,440	I. 310
England	500	500	.....
Germany	24,710	22,010	D. 2,700
Hungary	110	85	D. 25
Italy	3,220	2,600	D. 620
Norway	10,425	9,425	D. 1,000
Russia	22,310	25,570	I. 3,260
Servia	4,845	6,885	I. 2,040
Spain and Portugal	50,255	52,045	I. 1,790
Sweden	2,000	2,000	.....
Turkey	600	1,000	I. 400
Total Europe	121,105	124,560	I. 3,455
Africa	15,205	16,980	I. 1,775
Australia	40,315	41,840	I. 1,525
Japan	46,000	55,000	I. 9,000
Total	855,685	873,460	I. 17,775

According to this estimate the gain in the world's copper production has been very slow during the past two years. The production in 1909 showed an increase of 11.3%; but the gain in 1910 was only 1.9%; and in 1911 it was 2.1% as compared with 1910. In North America the increases in the United States and Cuba were nearly offset by the losses in Mexico and Canada. In South America the gain was almost entirely from Peru. In Europe most of the changes were small, the larger proportional increases being in Russia and Servia, while there was a decrease of 10.9% in Germany. In the other countries the only noteworthy change was the large increase in the Japanese production.

Amendment to Abolish Law of the Apex

Washington Correspondence

Senator Smoot, of Utah, has introduced a bill to amend Sec. 2322 R. S., which, if passed, will put an end to the "law of the apex," over the interpretation of which there has probably been more litigation than any other law controlling the acquisition of mining claims on the public domain.

The amendment is to the effect that the locators of claims heretofore made on any mineral vein on the public domain, shall have the exclusive right to the lands so located and the veins apexing therein, as permitted by the customs, regulations, and laws in force at the date of their locations, but after the passage of the amendment the locators shall, subject to such other rights as pertain to claims located prior to the passage of the amendment, have the exclusive right to all the surface included within the lines of the locations and of such veins in place as lie within the block of ground bounded by vertical planes passing through the surface lines, and no locator shall have the right to follow any veins outside of the limits of such claim.

Section 2 of the amendment is to the effect that notice of location of all mining claims, lode or placer, made after the date of the passage of the amendment, must be filed for record with the register and receiver of the land district within which the lands are situated within one year from the date of each location.

Guggenheims Offer to Sell Alaska Railroad

According to the *Sun*, the Guggenheims have offered to sell the Copper River & Northwestern R.R., in Alaska, to the United States Government. A conference was held at the White House, on Apr. 5. The Guggenheims were represented by two of the brothers, Daniel and Simon. Secretary of the Interior Fisher and President Taft participated in the conference and Vice-President Sherman called to present Daniel Guggenheim to the President.

While the meeting did not bring out a flat offer from the Guggenheims, they made it apparent that they would be glad to have the Government take over the railroad at the actual cost to them. It is estimated that the Guggenheims have put about $20,000,000 into the railroad. The original purpose in building the road was to open up the Bonanza copper mine, but the Guggenheims counted on much additional tonnage from the opening up of the Alaska coal fields.

Practically the entire traffic over the Guggenheim's $20,000,000 road has been the ore from the Bonanza mine. With a great coal bed within 50 miles of the railroad they have been obliged to pay $14 a ton for coal to use in their locomotives. The Copper River railroad has consequently been a losing venture, and now that the Taft administration is seriously urging the building of a trunk line by the government the Guggenheim interests apparently will be glad to have the Government take their railroad holdings in Alaska off their hands.

There is a good deal of doubt now, however, whether the Government would consider acquiring the Copper River line. The route that Secretary Fisher has recommended for the Government line lies 200 or 300 miles west of Cordova and starts from Seward as a seaport. The Federal railroad as proposed by Secretary Fisher would open up the Matanuska coal field instead of the Bering field.

With a Government road constructed into the Matanuska fields there would be no likelihood of the Bering coal fields being opened for many years, inasmuch as the Matanuska fields are supposed to have a superior quality of coal and would easily be able to supply the market demand. This would mean that the Bering field would fail to yield any tonnage to the Guggenheim railroad and that the Copper River & Northwestern would be obliged to continue to depend for its income chiefly on the ore haul from the Bonanza mine.

Marketing of California Oil

Under this head it was stated in the Journal of Mar. 30, that the proposal of the Union Oil Co. to issue certificates for the accredited oil in storage at a guaranteed price of 35c. per bbl., had been accepted by the Independent Agency. Further details of this transaction are now available.

The agency agrees that in the event of the price returned being less than 35c. per bbl., the difference will be borne by the current production. The agency further agrees that no agency oil will be sold to any marketing concern during the life of the certificates without the approval of the Union, and that no new members will be accepted into the agency during the life of the certificates without the approval of the Union. The agreement which fixes the life of the certificates is four years from and after Mar. 31, 1912. By this plan, the agency members may retain their storage in the form of certificates and participate in possible advance in price, or they may sell and have the present use of the money.

At present, the agency is able to dispose of only about 10% of the current production, while under the Union proposal with the storage oil practically removed from participation, the current sales will amount to approximately 90% of production. The Union is carrying about 65% of the stored oil, while its proportion of production is about 23,000 out of a total agency production of about 51,000 bbl. per day. The agency sales amount to 1,520,000 bbl. per month; of this amount, 240,000 bbl. go to the refinery. In 1911, the average monthly sales were 1,133,333 bbl.; the monthly average in 1910 was 693,630 bbl. The difference is partially accounted for by the admitting of the Union Oil Co. into the agency. The average price for the 12 months of 1911 was 31.8c. per bbl., and for 1910 the average price for 11 months was 38.08c. per bbl. The total agency sales in 12 months of 1911 were 13,600,000 bbl.; the total sales in 11 months of 1910 were 7,630,000 barrels.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Co-operation in Research Work

I would that "Consulting Chemist" had been possessed of sufficient courage of his convictions to have affixed his signature to his recent reply to a note of mine; which appeared in the columns of the JOURNAL,[1] and thus obviated the necessity of imposing our discussion upon uninterested readers. However, I cannot allow him to rest under such misapprehensions concerning the scope of the work of the Industrial Research Department of the University of Pittsburgh.

His line of distinction, so tightly drawn that every scientist connected with an institution of learning should work purely and simply along scientific or semi-scientific lines, his sole remuneration being the "consciousness of benefiting the race," would, if put into practice, keep many of the better men out of our engineering schools. On the other hand, apart from material considerations, if the consulting chemists would, more often, publish results giving others the same benefit of their work as they obtain from the scientists' publications, it would be a great aid to the advance of science.

From "Consulting Chemist's" note I take it that he feels that coöperation must signify a gratuitous unravelling of problems impossible to him but to all of which we know the solution by instinct, as it were—or the ultimate doing away of the consulting chemist himself by the absorption of his entire work by the industrial research worker.

It is not necessary to say anything concerning the absurdity of such a conception. With us coöperation consists in throwing open to the industrialist, who has a problem for solution, the research facilities of the university. We cannot do it gratuitously, for much of the success of our work lies in the fact, that for each industrial problem we obtain the services of a specialist in that particular line. That he is furthermore aided and abetted by favorable conditions of environment and equipment, for the obtaining of results in a short time, assures a larger return for the money invested than ordinary conditions could possibly produce.

"Can he not cut prices because he is protected by a steady college salary?" This idea is altogether wrong. Our salaries are paid entirely by the industrialist for whom we are working. We pay for our laboratories, offices, etc., by the instruction which we give in the university. That salaries are perhaps better than those given either by colleges or industries alone is not indicative of a "cut in price" and, still further, the system of industrial fellowships takes care of its Fellows, by giving, in many cases, a substantial bonus for the successful solution of the problem.

In conclusion, I would merely ask that our "Consulting Chemist" who has been so interested, continue his interest to the point of investigating our work in detail. I can furnish no more conclusive evidence that the engineering school and industrialist are being drawn closely together with advantages to both, that we are not, as he would have it "at the parting of the ways."

R. C. BENNER.

Pittsburgh, Penn., Apr. 1, 1912.

[1]Cf. Eng. and Min. Journ., Dec. 16, 1911; Feb. 10, 1912.

The Mathematics of Copper Sampling

In discussing Edward Keller's paper on copper sampling, in the JOURNAL of Apr. 6, 1912, one labors under the disadvantage that Doctor Keller is the master of us all in this particular field. However, on the practical basis, I think Doctor Keller has himself stated the objection to his theoretically correct one-hole sampling method, in that sampling must be done in such manner as to guard against intentional dishonesty.

Concerning Doctor Keller's criticism of my own article, I had considered his point, that a drill hole cuts several vertical layers of varying tenor, but I had considered that if the average assay of these layers was A, that the layers on each side would have values $A + \Delta_1 A$ and $A - \Delta_2 A$, etc., where $\Delta_1 A$ and $\Delta_2 A$ were very small quantities, and that what one might term the integration over the entire area of the drill-hole circle would be correct. (Passing to three dimensions, I believe that this argument applies to the drill-hole volume also.)

While Doctor Keller's practice has proved, with honest shippers, that the one-hole and full-template methods give concordant results, my own experience has certainly led to the belief that the thin slab with small bevel is much easier to sample correctly than the thick bar, with large bevel, while it is also my belief that in actual work on unknown bullion, the differences between Doctor Keller's and my ideas would be infinitesimals of the second order.

Doctor Keller's point about quarter or half templates being superior to whole, is good. I think it might well have been further emphasized.

DONALD M. LIDDELL.

Elizabeth, N. J., Apr. 8, 1912.

Secondary Sulphide Enrichment

A paper on secondary sulphide enrichment by H. V. Winchell appears in the JOURNAL of Feb. 17, 1912, in which he refers to a description of the Katanga copper deposits by a German geologist in the *Zeitschrift für praktische Geologie*. I do not know to what paper he refers, but an article by O. Stutzer, in the July number,[1] describing the Star of the Congo mine, takes a different view.

The latter states that the malachite ore is derived from primary sulphides, probably in quartzite, which have been oxidized, dissolved, and redeposited as oxides and carbonates in the adjacent clayey and sandy rocks; that the present richness of the oxidized ores is naturally no criterion as to the content of the primary ore, but probably due to a concentration of the copper from rock already eroded; and that the depth of the present oxidized zone, and the length of life of mine, can only be determined by boreholes, thus indicating that he does not expect any zone of secondary sulphide enrichment will be encountered.

It is difficult, however, to understand why Winchell considers the fact that these deposits are in a sandstone as discouraging the possibility of a zone of glance and bornite. Lindgren[2] has reviewed as a type a large number of deposits occuring in sandstones or shales where chalcocite and bornite are the predominant minerals, and which on the surface show malachite ore. A deposit of this kind occurs at Atbasar in Siberia[3], where it is estimated 389,000 tons of approximately 11% ore are developed.

The heading "Secondary Enrichment Can Only Occur Under An Iron-Oxide

[1]O. Stutzer: Die Kupfererzlagerstätte Etoile du Congo im Lande Katanga, Belgisch-Kongo; Z. f. p. G., July, 1911, 240-243.

[2]W. Lindgren: Copper (silver), lead, vanadium and uranium ores in sandstone and shale; Economic Geology, September, 1911.

[3]Min. Mag., January, 1912; Report of Atbasar Copper Fields, Ltd.

Hat" is presumably the work of the paragrapher and not the author. It might be well to emphasize that the Germans do not always use the term "Iron Hat" in its literal sense, but often apply it generally to the oxidized zone of an ore-body.

C. T. BRODRICK.

Kyshtim, Russia, Mar. 12, 1912.

[We have communicated with Mr. Winchell, who has sent the following comment.—EDITOR.]

My volumes of the *Zeitschrift für praktische Geologie* seem to be at the binders, and I am unable at this moment to refer to the number containing the article upon the Katanga copper deposits, mentioned in my paper on secondary enrichment. I do not think the article to which I referred was by Stutzer, and I am quite certain that I did not misunderstand the author. He stated very positively, and as it seemed to me, without any sufficient evidence, that the ores are the oxidized upper portions of enormous sulphide bodies.

HORACE V. WINCHELL.

Minneapolis, Minn., Apr. 3, 1912.

The Canon Diabolo Crater

Is not the idea that the Cañon Diabolo "crater" is the result of the impact of a meteorite more than a mere "popular idea," as implied in the "By the Way" column of the JOURNAL of Apr. 6, 1912. Although I have never visited it, from my reading I had gathered that there was no evidence whatever for volcanic action there. That craters formed by meteors are no new idea is shown by the writings of some of the recent selenographers, who attribute many of the moon's craters to that cause.

The idea of prospecting for the meteorite was no haphazard idea, as careful calculation had shown that a mass large enough to produce the effect noted would, if of a composition like that of the ordinary meteorite, yield an output of iron and nickel well worth trying for. Diamonds may have been thought of as a side issue, they are not unknown in meteorites, but if looked for in a meteoric-iron matrix, this should not be called searching for a diamond "pipe."

I was under the impression, too, that drilling was not unsuccessful, except that the drills hit nothing of value, but that drilling was abandoned because of the small chance of hitting anything. That is, it was impossible to tell at just what angle the meteor had entered the earth, or how far down to drill, and that it was believed that the only feasible thing was to follow the "crater" down.

As an interesting side light, it is said the Indians have a tradition concerning the fall of a great meteor in this region.

A. A. NASON.

New York, Apr. 8, 1912.

Where Should the Primer Go?

With regard to the discussion in the JOURNAL of the question, "Where should the primer go?" it seems to me that any attempt to make a flat uncompromising statement that the primer should *always be,* the first, the last, or in any other definite position, in every case, is simply an exhibition of hidebound, slavish following of local customs, without any regard to the conditions that may exist.

F. H. Gunsolus, in the JOURNAL of Mar. 30, 1912, in the last part of his letter makes two statements of fact which seem generally to have been lost sight of by the other correspondents.

Mr. Gunsolus says, "From results obtained, no difference in execution of the explosive was noted (by various positions of the primer in experiments carried on by the Du Pont Company), etc. . . . From an economical standpoint and also to eliminate the liability of igniting the explosive in the bore hole, it is best to place the primer in the bore hole last or next to last."

The question therefore as to which position of the primer will give the best results in actual execution of work may be dismissed as not being of sufficient practical importance to be considered.

It would seem that the governing rule to be followed is the rule of economy as expressed in Mr. Gunsolus' last statement. This rule, like all rules, is subject to modification or suspension in special cases.

It will be admitted, I believe, by every one, that if three feet of fuse is required to light a charge safely, say for example in a hole three feet deep, when placing the primer at the top, six feet of fuse will be required if the primer is placed at the bottom of the hole! He is a brave man indeed, or a foolish one, who in lighting a round of holes will permit the fire from any fuse to disappear in the hole without dropping everything and making for cover.

It has been demonstrated by experiments carried out by the U. S. Bureau of Mines that the rate of burning of a fuse compressed in a bore hole is apt to be much more rapid, depending on the nature of the tamping, than the same fuse burning free. It is therefore unsafe to rely in any way on the length of fuse that may be tamped in a hole, as affecting the time of explosion.

In a large mine managed several years ago by me there were fired on an average about 17,000 holes per week. Of this number fully 16,000 were in stopes and tunnels in the ore, the remaining 1000 being in tunnels and shafts in the rock.

In all holes blasted in the ore the primer was placed last in the hole. A careful record was always kept of misfires and the cause of same where ascertainable. I recall but few cases where the cause of misfire was due to breaking off the neck of the hole and throwing out the primer. In fact the percentage of misfires from any cause was low.

To illustrate the rule of economy in this case, suppose we have blindly decided that the primer should have been placed in every case at the bottom of the hole. Assuming that the holes averaged three feet in depth we would have used approximately three extra feet of fuse to each hole or about 48,000 ft. extra per week, which at the current price of fuse in that locality would have meant an additional expense of approximately $300 per week and no practical advantage gained.

On the other hand in shafts and tunnels in the country rock the general rule was to place the primer first in the hole, using the best quality fuse that could be bought.

This rule was followed not because of any theory as to extra execution or as to what might happen if the primer was placed anywhere else but because we found by experience that this rock shattered so badly in breaking that the blowing off of the neck of an adjacent hole was a frequent cause of misfires. Here then it was economy to be extravagant. In no case did we consider the fuse buried in the hole in calculating the time allowance of explosion.

While I have confined myself to fuse blasting the same reasoning applies to electric blasting.

It is absolutely essential for economical work to experiment in each kind of rock or ore to be blasted until the right combination is struck.

JOHN F. FULLER.

Honesdale, Penn., Apr. 8, 1912.

Research Work in Technical Schools

I note with interest L. W. Bahney's remarks in the JOURNAL of Mar. 23, 1912, under the above title, which in all except one point agree with my own views. There are exceptions to his statements that "when an experienced assayer is engaged by a mining company he is given about a week in which to get his bearings and adapt himself to new conditions, and that the beginner in an assay office will be given a week in which to learn the routine."

The first position I had after leaving college was in a small smeltery laboratory, where the only assistance was a day laborer to buck samples. The former chemist had apparently left "between two days," and the first day I had to clean up the laboratory and run about 70 determinations, both wet and fire. I think that in small plants such things are not unusual, and that "An Assayer's" article (Feb. 27, 1912) is founded on good common sense.

ANOTHER ASSAYER

Denver, Colo., Mar. 28, 1912.

The Dome Mine, Porcupine

Special Correspondence

On March 30 the Dome mill was officially started and the entire property opened for public inspection. Three of the eight development shafts are in operation; the others are being used as ore passes. No. 2 shaft will eventually be the main opening. Underground work is now confined to the 45-ft. level, the ore being mined at the surface and sent down mill holes; it is then hauled up an incline to the crushing plant.

The Porcupine mining district has been coming in for a good deal of attention lately on account of the official opening of the Dome mill on March 30, when, for the first time in its history, the Dome mine was thrown open to inspection, and was visited by many people from all over the country, approximately 1000 visitors being entertained on the property.

The construction of the mill has been under the supervision of the Merrill Metallurgical Co. and the results of the trial run have fully justified the confidence of the owners. Mr. Merrill has stated that the Porcupine ores lend themselves readily to treatment, and that an extraction of at least 95% can be obtained at the Dome.

To date the greatest part of the underground work has been confined to the 45-ft. level, the lack of power interfering with development on the 100- and 200-ft. levels. A new electric-driven compressor with a capacity of 1200 cu.ft. of free air per minute is being installed, and when this is in operation there will be plenty of power for all the projected work.

THE DOME MILL AND HAULAGE INCLINE, PORCUPINE, ONT.

EIGHT DEVELOPMENT SHAFTS

Originally the property was opened by means of eight shafts, seven of which were sunk on the first discovery, commonly known as the "dome," on account of large rounded masses of quartz, which are at a greater elevation than the surrounding country. The other shaft was sunk to a depth of 100 ft., to develop a later discovery, known as the "Golden Stairway" vein, which is probably a continuation of the main orebody.

Of the seven shafts, two were sunk to the 100-ft. level while another was carried to 200 ft. The remainder were sunk only to the 45-ft. level. Three of these eight shafts are now in operation, the others having been converted into ore passes. No. 1 is a three-compartment shaft which was sunk to the 100-ft. level and will take care of all the development work for the present. No. 7 was sunk to the 200-ft. level and is used for prospecting purposes only. A crosscut was started to intersect a point underneath another shaft and from which a raise will be carried up to the 100-ft. level. When this is completed, the No. 7 shaft will be abandoned and used as an ore chute. The No. 2 shaft was sunk to a depth of 100 ft. at a point about 100 ft. south of the Golden Stairway vein. No work is being done on this at present on account of the shortage of air. The intention is, however, to start sinking this shaft as soon as possible and continue it to the 400- or 500-ft. level. On account of its central situation this shaft will eventually become the main opening on the property and the work of attacking the orebody will be carried on solely from this point, the ore being transferred to the crusher station by means of a rope haulage. A 60-ft. headframe is now being erected over this shaft.

At present, however, the main opening of the mine is the incline from the crusher station to the 45-ft. level. This incline, which is 350 ft. long, has a gradient of 13.55%, the ore being hauled up the incline in side-tipping, V-shaped cars, by means of a single-drum hoist. Six cars are hauled at a trip. The incline, while serving as a means of development for this end of the property, provides a most convenient and economical method of handling the ore, and leaves the main shaft free for carrying on the development work. At the bottom of the incline is a drift 140 ft. long and 8 ft. wide, which is connected with the workings on the 45-ft. level. This drift is double tracked and provides plenty of storage room for both empty and loaded cars.

DEVELOPED ON 45-FOOT LEVEL ONLY

The development on the 45-ft. level is laid out on the rectangular system, and embraces an area roughly 400x450 ft. Two main drifts were run parallel and 175 ft. apart, and these are intersected by

four crosscuts 100 ft. distant from each other. The main shaft is situated 80 ft. to the north of the No. 1 drift and is connected with it by the main crosscut and two bypasses, one on each side of the crosscut, and at an angle of 45° with it. This provides easy access to the shaft and gives plenty of station room.

The main drift has a grade of 0.66% toward the incline and all the crosscuts have a grade toward the main drift. The No. 2 drift is practically level. This provides a complete circuit of the mine with only a slight grade against the empty cars, the loaded cars always having a down grade. At present the tramming is done by men, but later mules will be introduced.

"bulldozed" at the surface. The chutes are so constructed that blasting may be done in them at any time. The mine is worked on two 8-hour shifts and all the mining and tramming is done in the day time. The ore above the 45-ft. level will all be mined from the surface, thus giving low working costs. This system of mining will also be carried down to the 100-ft. level.

The cars from the loaded chutes are run to the bottom of the incline and hauled up to the No. 7½ gyratory crusher. The crushed ore is transported to the No. 3 crusher house by means of an inclined conveyor belt, the undersize passing through a grizzly, which is just below the discharge from the head of the

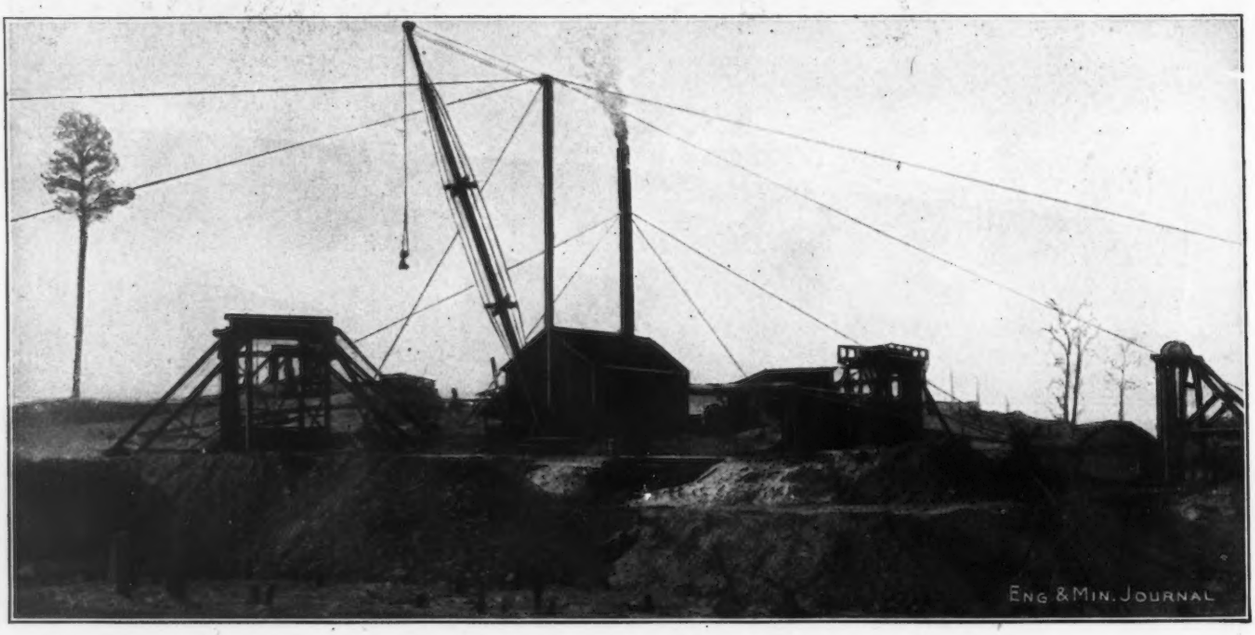
ft. level. From the bottom of the incline a drift will be run to connect with the workings from the bottom of No. 2 shaft. Crosscuts will be run at intervals from this drift to determine the extent of the orebody. Development work will also be carried on to the east of No. 2 shaft where diamond drilling has indicated the extension of the mineralized zone and at the same time this shaft will be sunk as rapidly as possible and new levels done at greater depth.

Shannon Copper Company

During the fiscal year ended Aug. 31, 1911, the Shannon Copper Co. extracted 263,975 tons of ore, against 311,456 tons

STARTING MINING AT THE SURFACE NEAR THE DOMES

THE INCLINE TUNNEL AND MAIN SHAFT, DOME MINE



FOUR SHAFTS ON THE DOME MINE, PORCUPINE, ONT.

Seven raises were put up to the surface and these combined with the old shafts give 11 working places. Two of these raises are indicated by arrows in the upper left-hand halftone. Specially designed chutes or boxes were built at the bottom of the raises, the ore being shot into the raises from the surface and loaded directly into the cars from the chutes. These raises are kept full of ore so that large blocks from heavy blasts may be

belt. The undersize and the crushed ore from the No. 3 crushers passes directly to the mill conveyor belt, set at an angle of 20°, which carries the ore to the mill bins.

The development plans call for a somewhat different system of underground workings than were run on the 45-ft. level. In addition the raises will be spaced further apart, as working in toward each other from that depth they will not need to be as close as those above the 45-

during the previous year. From this 14,944,933 lb. of copper was produced, at a cost of 9.92c. per lb. at Clifton, and 11.5c. at New York. The price received was 12.352c. per lb. Shannon costs, per pound of copper, have shown a constant decrease since 1905, the costs at New York being: 1905-6, 14.6c.; 1906-7, 14.5c.; 1907-8, 12.6c.; 1908-9, 12.2c.; 1909-10, 12.1c.; 1910-1, 11.5c. per pound.

During the year the company has been

experimenting with its low-grade ores, of which is possesses from 1,000,000 to 1,500,000 tons, assaying 2 to 2½% copper. Although this ore is easily mined, in the past it has not been considered as pay ore, but recent experiments lead to the belief that it may be treated at a profit. The company's outside mining properties are showing up well, two of them having shipped sufficient ore to leave a profit over their development expenses.

DEVELOPMENT

Development during the year amounted to 7645 ft. of drifts and crosscuts. Much new smelting and concentrating ore was opened, but owing to irregularities in shape and composition of orebodies it is impossible to give accurate estimates of ore reserves. The outlook for the low-grade ores has already been spoken of. Mining is still being done by the square-set system, and so long as circumstances force this to be done, no material reduction may be anticipated in present mining costs.

There were no changes made in the blast-furnace department during the year. There were 56,000 tons less of burden handled, and operating costs were slightly lower. The output from custom ores was 223,169 lb. making a total production of 15,168,102 lb. Concentrator costs remained the same, the tonnage handled being considerably less.

The last of the Shannon Copper Co. bonds has been retired, although there are still $600,000 in bonds outstanding on the Shattuck-Arizona Railway Co., guaranteed by the Shannon Copper Co. The railroad carried its fixed charges during the year, and a small balance on its stock.

Cadmium and Nickel in Cyanide Bullion

By FREDERIC P. DEWEY*

In common with many others, the United States Mint service experiences much difficulty from the erratic results obtained at times in assaying bullion produced by cyanide mills. The bullion produced by the celebrated Mercur mine in Utah is deposited in the United States Assay Office at Salt Lake City, Utah, and is thence transferred to the mint at Denver. Occasionally serious differences occur in the settlements between the two offices which are referred to the Bureau of the Mint for adjustment. The Salt Lake samples from one group of three bars were subjected to an extensive investigation. The Salt Lake office took four samples from each bar, two dips and two drills, and assayed each sample in duplicate. These samples were then sent to four other laboratories in the service for assay. The accompanying table details the results reported, giving the fineness in gold shown by the eight Salt Lake assays, and the test assays made in the independent laboratories.

ASSAY EXPERIMENTS ON GOLD BULLION FINENESS

First Bar			Second Bar			Third Bar		
Fineness	Salt Lake Assays	Test Assays	Fineness	Salt Lake Assays	Test Assays	Fineness	Salt Lake Assays	Test Assays
827.2	.	2	816.9	1	..	830.5	1	..
.3	1	..	817.2	1	..	831.5	1	..
.4	1	..	.3	.	3	832.1	.	1
.7	.	3	.5	.	1	.3	.	3
.8	.	1	818.3	.	1	.4	.	1
828.3	1	..	.4	.	1	.5	.	1
.4	.	2	.5	.	1	.8	.	3
.5	2	1	.6	.	2	.9	.	2
.6	.	3	.7	.	1	833.0	.	4
.7	1	4	.8	1	..	.1	1	3
.8	.	4	.9	1	2	.3	.	3
829.0	.	4	819.0	1	1	.4	2	2
.1	.	4	.1	.	3	.5	1	8
.2	1	5	.2	.	1	.6	1	1
.3	.	6	.3	.	1	.7	.	2
.4	.	3	.4	.	1	.8	.	3
.5	1	5	.5	.	3	.9	1	..
.6	.	4	.6	1	6	834.0	.	4
.7	.	1	.7	1	2	.1	.	2
.8	.	3	.8	.	2	.4	.	3
.9	.	3	.9	.	4	.5	.	1
830.0	.	4	820.0	1	7	.7	.	1
.1	.	1	.1	.	1	835.0	.	1
.3	.	1	.2	.	4	.4	.	1
.4	.	1	.3	.	2	.6	.	1
.5	.	1	.5	.	1	.9	.	1
.....	.	..	.6	.	3	.....	.	..
.....	.	..	.7	.	2	.....	.	..
.....	.	..	.8	.	1	.....	.	..
.....	.	..	.9	.	2	.....	.	..
.....	.	..	821.0	.	2	.....	.	..
.....	.	..	.2	.	1	.....	.	..
.....	.	..	.4	.	1	.....	.	..
.....	.	..	.5	.	1	.....	.	..
.....	.	..	.8	.	1	.....	.	..
.....	8	66	.....	8	65	.....	8	52

A part of the differences shown in these assays is undoubtedly due to the samples, but the chemical composition of the bullion affects the sampling as well as the assaying. It was, therefore, desirable to know the composition of the bullion. Some preliminary tests had already been made on a previous shipment of Mercur bullion. Therefore 18.5 grams of the third bar above were subjected to a most careful qualitative examination.

This analysis showed trifling amounts of silver and lead, and considerable copper. It also showed the presence of cadmium in an amount which was large as compared with the zinc present. An unusual amount of iron was shown. The most surprising point, however, was the presence of a notable amount of nickel and this nickel was so free from cobalt that it gave the characteristic nickel bead with borax. There were also some indications of tellurium but the reactions were obscure and there was not enough material to obtain decisive tests.

Undoubtedly the cadmium in the bullion was derived from the zinc used to precipitate the cyanide solutions and the large amount shown may have been due to the use of blue powder unusually rich in cadmium, although a concentration of the cadmium by the cyanide operations is possible.

Four other samples of cyanide bullion from mills in Montana have also been examined qualitatively. The Kendall bullion showed much cadmium and only a moderate amount of zinc. It showed a large amount of nickel, comparatively speaking, but only trifling amounts of iron. The Gold Reef bullion showed a moderate amount of cadmium, but a large amount of zinc. It also showed a large amount of iron and a notable amount of nickel. The Ruby Gulch bullion showed a moderate amount of cadmium, but a comparatively small amount of zinc. It also showed a little iron and gave a good test for nickel. The Cumberland bullion showed only a small amount of cadmium, and also a small amount of zinc. There were only traces of iron, but there was a good test for nickel. In no case was there sufficient cobalt to obscure the nickel in the borax bead. All the samples showed silver, lead and copper.

Undoubtedly the nickel in these cyanide bullions was derived from the ores. Aside from showing a wide distribution of nickel in small amounts, they are interesting as being practically free from cobalt. It is fair to assume from our general previous knowledge of the intimate association of these two metals in nature that the ores carried slight amounts of cobalt as well as nickel, but that the cyanide operations effected a separation of them. Other samples of Mercur bullion have been examined for cadmium and it has always been found. A sample from the Goldfield Consolidated company, which was supposed to be a cyanide bar, did not show cadmium, but also it did not show zinc. It did, however, show bismuth.

*Assayer, Bureau of the Mint.

Note—Published by permission of the Director of the Mint.

These qualitative analyses open up a wide variety of possibilities as to the cause of the discordant assays so often obtained in cyanide bullion, and a systematic series of assays is now being made on synthetic cadmium alloys, for the purpose of elucidating the problem.

Smelting in Mexico

Stockholders of the American Smelting & Refining Company in annual meeting on Apr. 13, heard Vice-President Edward Brush discuss the effect on the company's operations in Mexico of the renewal of revolutionary activity. He said that what was giving the company most concern was the refusal of the United States Government to allow the shipment of dynamite to Chihuahua, where there is only one month's supply.

Three out of five furnaces at the Chihuahua plant are in operation, and while shipments to El Paso are blocked over the Mexican Central, ore is being sent over the Northwest route, and it is expected that the full battery of furnaces will be put in operation before long. Velardeña plant was closed down for about a week, but is now in full operation. Last year the Chihuahua mines and smeltery closed down on account of strikes, and transportation was interrupted by the revolution, but total loss to the company was no more than $200,000.

Having been through one revolution without disastrous results, he said, the directors feel that there is every probability that the new situation will not prove more serious than the old. Both the rebels and the government are interested in keeping the mines and plants running, recognizing that they are the life of the country and the chief factors in the support of the government-owned roads.

Shortage of Dynamite in Mexico

One of the most critical matters at the present time is the rapidly lessening supply of dynamite in Mexico for the continuance of mining work. Within a very short time, days not weeks, many mines will be compelled to shut down, says a correspondent of the *Evening Post,* turning loose on the land thousands of laborers of the wholly ignorant class who may be expected to join the revolutionary forces. There are at the present time 15 cars of dynamite at El Paso, each containing 800 or 900 cases of dynamite, but the United States Government will not release them to Juarez without the consent of Madero, and this he refuses to give, fearing, with reason, that they will be confiscated by the revolutionists to be converted to their own uses, and not forwarded to the mines.

Large orders have been placed in Europe, to come by way of Vera Cruz, but the explosive cannot possibly arrive for several weeks, and therefore not in time to save the mines from closing. The government plant in Durango was seized by the rebels two or three weeks ago, stopping the supply from that source.

Utah Consolidated Mining Co.

The Utah Consolidated Mining Co., during 1911, shipped to the International Smelting & Refining Co., 162,522 dry tons of copper ore, carrying: Cu, 2.891%; Ag, 0.9815 oz. per ton; Au, 0.0936 oz. per ton; 7793 dry tons of lead ore, averaging: Pb, 22.164%; Cu, 0.655 %; Ag, 5.413 oz.; Au, 0.0854 oz.; and 512 dry tons of lead concentrates, carrying: Pb, 21.984%; Cu, 0.609%; Ag, 5.038 oz.; and Au, 0.0795 oz. The product from the tonnage shipped was: 9,-162,023 lb. Cu; 3,311,939 lb. Pb; 160,-367 oz. Ag; and 16,730 oz. Au. Profits amounted to $438,430 for the year.

In addition to the above ores there were 3238 tons of furnace bottoms shipped to the American Smelting & Refining Co. The lead concentrates were produced at the Winnamuck mill, at Bingham, from 2524 tons of second-class ore, and are, like the lead ores, covered by a five-year contract with the International company.

During the year, 18,799 ft. of exploratory work was done. A three-compartment, inclined working shaft was sunk 641 ft. from the seventh to the twelfth level. The eleventh level was opened, but although the orebodies encountered are large, they are too low-grade to be profitable at present. The territory west of the upper mine workings, in the limestone overlying the Highland Boy lime was also opened and first- and second-class lead ore found, but no copper. The porphyry dike which cuts the Highland Boy limestone is found to approach the footwall with depth, and the ore-bearing limestone lying between it and the footwall is decreasing. Five crosscuts were driven through the porphyry and five orebodies found, which present development indicates are small and of low grade.

The development of copper ore during the last year has not been satisfactory. All new ore found has been on the levels below the eighth, and the bodies, although large, were low grade.

Important lead orebodies were opened, and the work is still progressing in good ore. The principal body is on the California level, 150 ft. below the top level, at the contact of the upper limestone and quartzite. The ore extends along the contact for 300 ft., and is of 3 ft. average width. At depth the ore has been cut by a raise from the lower level, at a point 140 ft. on the dip below the California level.

The ore reserves are: 239,650 tons of copper ore, averaging 2.24% Cu; 0.603 oz. Ag.; 0.603 oz. Au; 23,785 tons of first-class lead ore, averaging 15.44% Pb; 1.04% Cu; 3.01 oz. Ag; 0.032 oz. Au; and 12,000 tons of second-class lead ore, averaging 6.8% Pb; 1.10% Cu; 0.350 oz. Ag; and 0.035 oz. of gold. Dividends of $150,000 were paid.

Rio Tinto Co., Ltd.,

The report of this company for the year ended Dec. 31, 1911, shows that the great mines continue to be operated as usual and with some increase in production. There was no material change in capital account during the year, the capital remaining at £1,625,000 preference and £1,875,000 ordinary stock.

The production for two years past was as follows, figures being in long tons:

	1910	1911	Changes
Pyrites for shipment.	637,020	649,215	I. 12,195
Pyrites for treatment	1,509,745	1,536,390	I. 26,645
Tatal	2,146,765	2,185,605	I. 38,840
Av. copper contents..	2.097%	2.144%	I. 0.047%
Pyrites sold	578,443	662,359	I. 83,916
Washed and sulphur ore	683,605	841,964	I. 158,359
Copper prod. at mines	22,790	21,880	D. 910
Copper in pyrites sold	10,633	11 505	I. 872
Total copper	33,423	33,385	D. 38

There was a continual strong demand both for pyrites and for sulphur ore for shipment. Deliveries of sulphur ore, both washed and crude, were much larger than in 1910. The preparation of the lode for future mining was continued as usual. Machine drilling, both in open-cut and underground workings, has given satisfaction and its use was increased. There was no scarcity of water during the year; the winter rainfall was excessive, operations in February suffering from floods.

The income account for the year was as follows:

Profit on sale of produce	£1,349,506
Interest, etc	4,095
Total receipts	£1,353,601
Taxes in Spain and elsewhere	£94,027
General expenses, interest, etc	109,079
Depreciation account	80,535
Staff provident fund	3,000
Total charges	£286,641
Surplus for the year	£1,066,960
Surplus from 1910	26,980
Total surplus	£1,093,940
Dividends paid	1,065,625
Balance forward	£28.315

Dividends paid were 5% on preference and 52.5% on ordinary shares. The report says: "The market price of cash standard copper was again lower in 1911 than in the previous year, the average price in 1911 being only £56 1s. 9d. a ton. This price is lower than the average market value of the metal for many years past, and compares with £57 3s. 2d. in 1910. For months past, however, the consumption of copper has increased and has been in excess of the production. The world's stocks are therefore very considerably reduced, and, if good trade should prevail in the consuming centers, there is every reason to expect the continuance of improved prices."

Details of Practical Mining

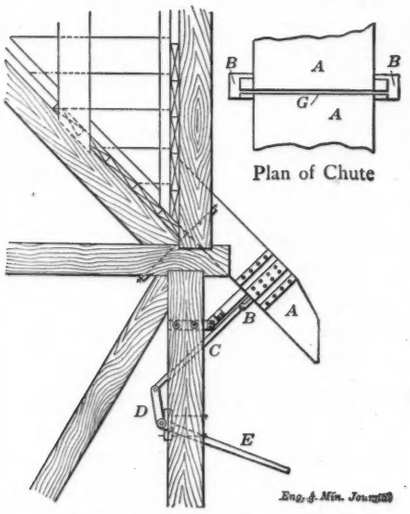
Accounts of Useful Ways of Doing Many Things in the Day's Work

Gate for Ore Bin Chutes

By Algernon Del Mar*

The accompanying illustrations show what in my estimation is one of the best gates for ore-bin chutes. It does not choke readily and can be used for coarse or wet as well as fine or dry ore. A gate of this type was furnished by the A. Leschen & Sons Rope Co. for the automatic loading station of their aerial tramway that I erected in Modoc County, California.

The sliding gate acts from below by a lever and slides up and down on wheels in a recess on the side of the ore chamber, but in such a way that the ore cannot get into these recesses. A boy can



Gate for Ore Bin Chutes

operate it and can load cars as fast as they can be run under the lip of the chute. When loading must be done expeditiously, for example where a train of cars must be loaded, I believe they could be loaded by the use of this gate while in motion. The amount of ore going through the chute is that sliding over the top when the gate is let down and nothing can choke the return of the gate to the position where it cuts off the stream of ore.

Referring to the elevation, *A* is a steel chute, *B* a sliding gate actuated by the levers *C*, *D* and *E*. By lifting the lever *E* the gate is lowered allowing the ore to run over the top of the gate. As the top of the gate can be lowered until it is flush with the bottom of the chute there is a clear passage. When it is desired to shut off the stream of ore the lever *E* is depressed throwing the gate up.

Referring to the plan, *AA* is the ore chute, *G* is the slot in the bottom thereof through which the gate moves in a vertical direction, *B*, *B* are the recesses or chambers in which the wheels which are attached to the sides of the gate slide up and down, so that the movement of the gate takes little effort.

*Mining engineer, South Pasadena, Calif.

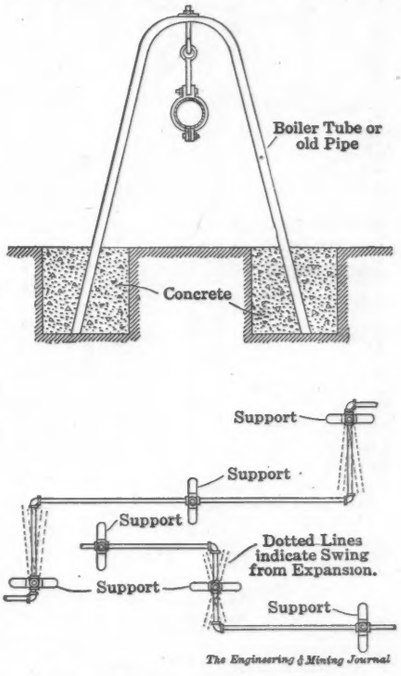
A Method of Hanging Air Pipes

By Claude T. Rice

The Copper Range company intends to connect its different properties in Michigan so that in case a compressor breaks down at one mine air can be delivered to it from another. Already the Trimountain and the Baltic mines are connected in this manner. The air pipe is carried above ground so that any leaks can be readily detected.

Supports of the type shown in the accompanying drawing are used. Timber legs have been used, but the support shown was found to be a good way of using old pipe. Any old piece of 2-2½- or 3-in. pipe or old boiler tube 8 ft. or more in length was used for the legs. This pipe was bent to a radius of 12 in. at the middle and the legs given a flare of one in four inches. Each piece of pipe was flattened at the top and a 1-in. hole punched through it to receive the ¾-in. hanger bolt that holds the air pipe. These pipe supports are footed in concrete pedestals about 24 in. on an edge and buried in the ground. The under surface of the top of the pipe is set to grade so that a constant and standard length of hanger can be used in suspending the pipes from the supports.

These supports are placed along the line at a maximum interval of 25 ft. No expansion joints are used in the entire line which is about 1½ miles long. Instead the expansion that would occur in the line with a change in temperature of 100° F. is figured for each straight stretch of pipe. This stretch of pipe is anchored at the middle, and the expansion is taken care of by the side swing of the pipes at the turns, or changes in direction. In case this would be too much to be taken care of in that way with the ordinary course of the pipe a double-angle turn or reverse bend is put in long enough to allow the expansion to be taken up by the swing of the pipe at this turn without danger of loosening of the joints. Often this turn is anchored in the middle so as to take care of the expansion of two stretches of pipe, but generally each turn is made to serve only one. In case that the stretch of pipe that must take up the expansion is short, the pipes are occasionally put in hot so that the end pipe of the expansion leg is pulled in the beginning in the opposite direction to that in which most of the expansion will occur. Owing



Old-Pipe Supports for Air Mains

to the pipes being suspended in swings at the supports, little resistance is offered to the movement of the pipes, and the expansion can be taken care of quite easily in this manner. It is a much better system than putting in expansion joints, even when the pipe has to be made somewhat longer to make room for the expansion turns.

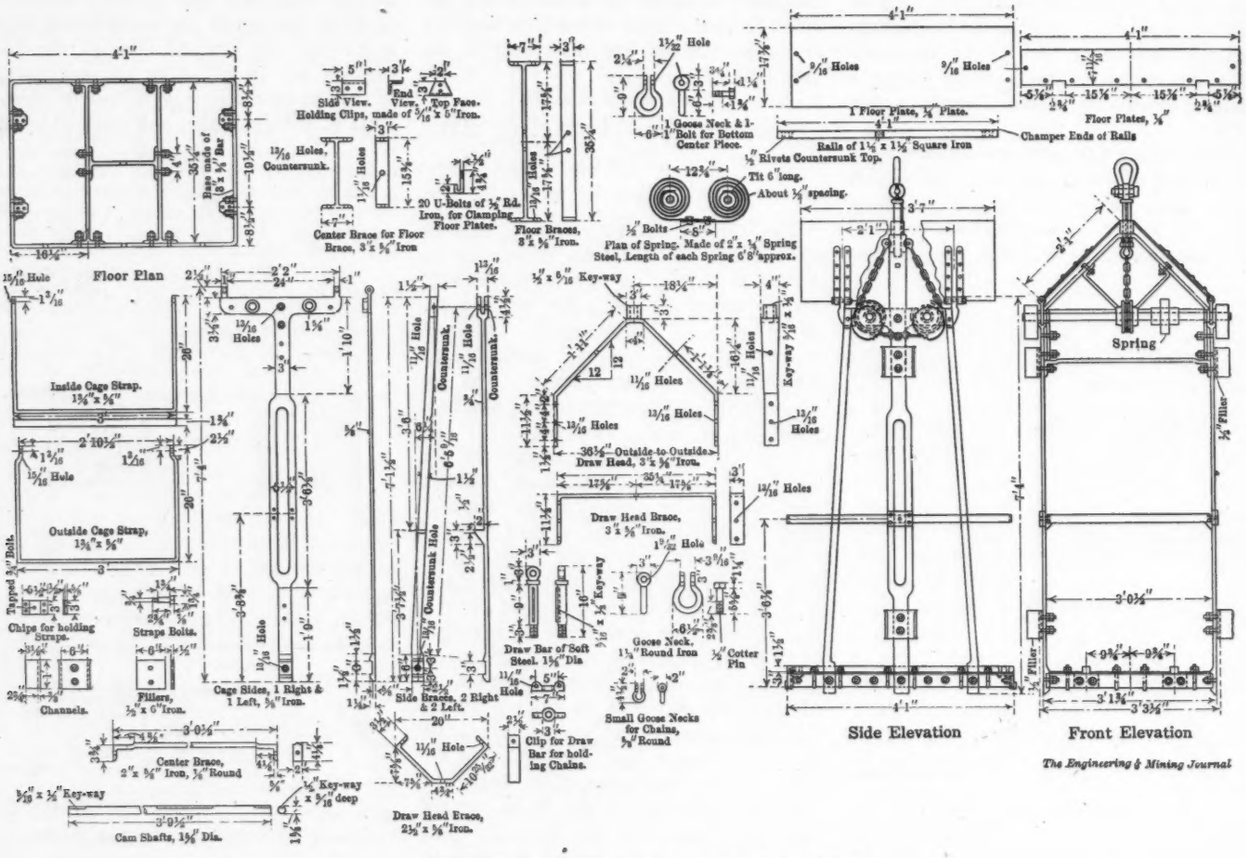
A 70-ton Bucyrus steam shovel, used on the Panama Canal excavation work, recently loaded 2900 cu.yd. of material in a working day of eight hours, states the *Canal Record*. During this time a delay of 1 hr. 50 min. was incurred by waiting for cars. This is the best record yet made by a 70-ton shovel since the work was begun by the United States.

A Light Mine Cage

By H. L. Botsford*

The accompanying illustration shows a type of cage used in the West. This cage is of light construction, and is used for hoisting small loads.

The springs are of the spiral type, two in number. The inner end of the spirals are fastened to collars keyed to the cam shafts, and the outer ends are bolted together. Unlike the cages recently described in these columns, p. 636, issue of March 30, 1912, and p. 688, issue of April 6, 1912, the springs are not attached to the frame of the cage. The light short shoes should be set as far apart vertically as can be conveniently done as the greater the distance between them, the more will they tend to steady the cage during hoisting.



Structural Details of a Light Mine Cage

cams are circular in outline, with grooved surfaces. They are mounted eccentrically on the cam shafts, which gives them their gripping effect upon the guides.

The bonnets of these cages are usually attached by hinges so that they may conveniently be swung up out of the way when long timbers are being lowered. It will be noted that the guide shoes are short, whereas in the cages recently described the guide shoes were nearly as long as the cage. For a cage of this type which is intended especially for raising small loads it is not necessary that the guide shoes be long. The two sets of

*Mining engineer, Creighton Mine, Ont.

The Walker Overwind Prevention Gear*

By John Paul

In designing the overwinding prevention gear, for the Mary pit of the Lochgelly Iron and Coal Co., Ltd., the object was to provide a simple, reliable, and inexpensive device, as it was felt that while there were many excellent appliances on the market, their excessive cost and complications were inimical to their general adoption. Moreover, as there is in the near future a prospect of the provision of overwinding appliances becoming compulsory, an effort was made to solve the problem in as simple and economical a manner as possible.

The first idea which was carried out was based on steam control, that is, it was argued that if the steam were shut off at a predetermined point during the wind, there would be a guarantee that the engineman had his engines under control. If some means, therefore, of insuring this were found, then the problem of preventing an overwind from the bottom was solved.

To prevent the cages from being started in the wrong direction, a simple trip-out, actuated by the cage itself, was considered to be the better method, as, where there is limited height between the landing-plates and the headframe pulleys, a trip-out actuated by the engine shaft was considered too slow.

After the gear was inspected by a number of mining officials; the objection was raised that, in the event of steam being shut off, and owing to the possibility of the engineman being overcome by sickness or other cause at the particular moment when he should check his engine by means of the brake or reversing lever, there was a danger of the cage being dumped into the pit bottom.

To eliminate this possible defect, it was decided to add a speed controlling device, and thereby cover all contingencies, the object being to insure that, whether steam was shut off or not, the speed of the engines would be reduced gradually towards the end of the wind.

The Walker overwinding prevention gear shown in the accompanying illustration, consists of a clutch plate, fitted

*A paper read at the December, 1911, meeting of the Mining Institute of Scotland.

with roller contact spring-pin mounted on the depth-indicator shaft, and connected to the steam-control valve by adjustable rods and levers. The bracket for carrying the indicator shaft and dial is mounted with two vertical sliding bars, fitted at the top with clearing contact heads and at the bottom with adjustable hook plates. The bars work in suitable guide slots, and an electric alarm bell is connected to the sliding bars. At the bottom of the indicator there is a horizontal cross trigger shaft mounted with two levers *B* for engaging the hook plates, and with two levers *A*, Figs. 1 and 2, for engaging with the clearing catch fitted to the cage indicator, and through the action of either of them to operate the trigger lever. The trigger lever is connected to a compound-lever arrangement which throws into action the emergency-brake lever, thus shutting off steam, and centering the reversing gear.

The apparatus comes into action as follows:—When steam is applied to the engines, the clutch plate is put into action automatically, and should the engineman fail to shut off steam at the proper moment, the contact pin in the clutch plate engages with the contact head of the sliding bar on one side or the other, according to the rotation of the engine, and thereby raises the sliding bar. The movement of the sliding bars causes an electric bell to ring, but if the engineman neglects the warning given, the hook plate, which is adjusted to the desired point of cutoff, engages with its lever on the trigger shaft, and through its action releases the trigger thus applying the brake, shutting off steam, and centering the reversing gear. Then, again, should the engines be started in the wrong direction, the catch on the cage-decking indicator comes into contact with its lever *A* on the trigger shaft when the cage has been raised two feet, or any predetermined distance above its mark, and the trigger is released, with the result already described. The spring on the pin in the clutch plate removes the only possible hindrance to the working of the engines while shaft work is being carried on, as in the position where the pin is immediately behind the contact head, steam can be applied. The act of putting on steam at that particular point causes the pin to be compressed into the box, and thus gives the necessary freedom for the clutch plate to move on the shaft.

The compound-lever arrangement gives a leverage of 72: 1, so that the strain on the indicator shaft is slight. The trigger is arranged in such a way that there is no chance of the emergency gear being thrown into action through vibration.

The apparatus in no way interferes with the ordinary working of the engines, and as steam must be completely shut off so as to allow of the contacts being kept clear, a guarantee is insured that the engineman has the engines under control, which is the object aimed at.

The variable speed-controller, Figs. 1 and 3, is designed to work, if so desired, in conjunction with the overwinding prevention gear already described, as a further safeguard, or it may be used as an independent prevention gear. It consists of an eccentric pulley and strap, fitted to the depth-indicator shaft, the eccentric rod being connected to one end of a double link, with the other end of the link connected to a governor worked with suitable gearing from the engine crank-shaft. The center of the double link works on a combined guide and trip-rod, which has a connection to the trigger shaft. The double link is fitted with a catch-pin on the governor end, and the catch is so arranged that the governor is prevented from rising at the beginning of the wind, so as to allow of acceleration of speed. The gear is mounted on a base plate, and the general arrangement is shown in the drawings.

The action of the speed controller is as follows:—Should the speed not be reduced towards the end of the wind, one end of the double link will be held up by the governor, and the other end, being raised by the eccentric, will lift the trip-rod, with the result that the trigger will be released. The emergency gear, which applies the brake, shuts off steam, and centers the reversing gear, is thus brought into operation. The controller can be adjusted by a screw on the eccentric rod, and by a screw on the trip-rod, so as to come into action at any predetermined point, after which it controls the speed for the remainder of the wind. It also acts as a preventive to the engine running in the wrong direction, as the action of the eccentric would actuate the trip-gear, and bring the emergency gear into action, in the event of the engine being started in the wrong direction.

FIG. 1. SIDE ELEVATION.

FIG. 2. END ELEVATION.

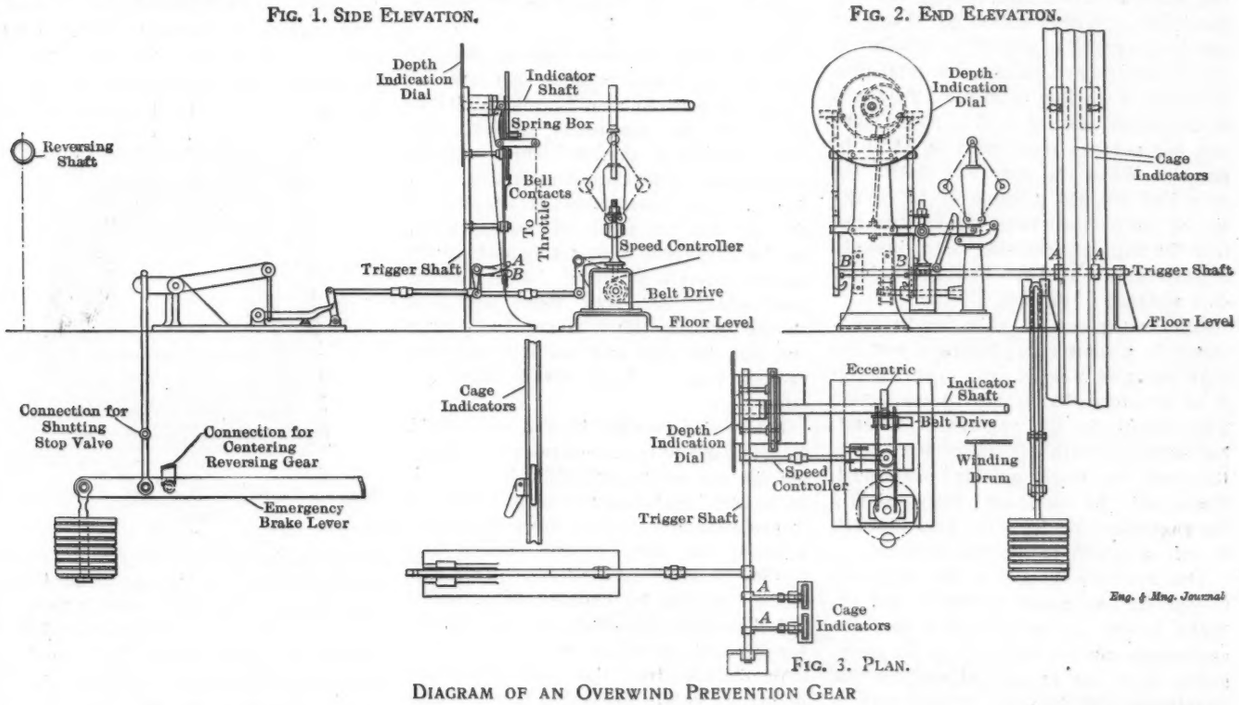


FIG. 3. PLAN.

DIAGRAM OF AN OVERWIND PREVENTION GEAR

The winding engines at the Mary pit, of the Lochgelly Iron & Coal Co., to which this overwinding prevention gear and speed controller have been fitted, consist of a pair of coupled engines with cylinders 24 in. in diameter by 60 in. stroke, working at a pressure of 100 lb. per sq.in., the diameter of the drums being 12 ft. and the depth of the shaft 864 ft. The engines make 23 revolutions per wind, steam is usually shut off at eight revolutions from the pit top, and the alarm bell rings at seven revolutions from the top.

The engineman can easily shut off steam after he hears the bell ring, and so avoid a trip-out. At five revolutions from the top, the gear comes into operation, in case the engineman should have failed to shut off steam, and the engines are thus brought to a standstill in two and one-half revolutions, leaving two and one-half revolutions still to go. The gear can be arranged to cut off or trip-out at any predetermined point. The total time occupied in winding is 26 sec.; the speed at maximum velocity is 52½ ft. per sec., and the average rope-speed is 33.23 ft. per sec. When the gear w s tested, the rope had attained a speed of 56 ft. per sec. at the moment when the engines ran into the trip-out, and th were brought to rest in two and one-half revolutions, or a distance of 93 feet.

After a trip-out the gear can be readjusted in a short time. During a test the time occupied was 20 sec. The trip-out is so arranged that it can be readjusted quite readily by the engineman himself, but naturally with assistance the operation can be more quickly performed. There will be sufficient delay, should the engineman readjust the gear himself, to call attention to his carelessness.

The ordinary brake is the one employed for emergency purposes, and the brake levers are so arranged that the engineman can use his lever, or the emergency lever can be applied without one interfering with the other, or both may be applied at once.

In shutting off steam the throttle valve is used, although an independent stop valve could more easily be adopted in this case. By using the throttle, the man can keep control of the steam by opening the valve after a trip-out, by exerting a little extra force on the steam lever so as to overcome the weight employed to shut it.

The reversing gear is centered by a 15-lb. weight, so that there is no obstacle to the engineman's handling his gear after a trip-out, and he can, in the event of his brake failing, reverse the gear, put on steam, and thus bring the engines to rest.

The brakes on the winding-engine drum are of the double-post type. The posts are rolled-steel beams, fitted with brake-blocks, the posts being set at an angle to insure easy release from braking. The total bearing area of the combined brake blocks is 729.76 sq.in. on a drum 12 ft. in diameter

Separating Rock from Clay*

By A. G. Charleton†

In 1904, I was called upon to advise upon the treatment of a tin ore in the East, which, like the ore described by F. A. Killik[1], contained an excessive proportion of stiff wet clay and kaolin, and after looking up all the published information upon the subject, I came to the conclusion that none of the methods then in use was suited to the conditions which had to be dealt with. These methods might be divided into: (1) Puddling machines; (2) log-washers (mechanically stirred); (3) trough-washers (hand stirred), and (4) "Crickboom" washing trommels.

On account of their limited capacity or expense, I was satisfied that none of these alternatives would prove satisfactory, and we eventually devised and recommended a method which closely corresponds with that described by Mr. Killik. The distribution of the tin in the ore did not admit of hand sorting, as the cassiterite was not in sufficiently coarse crystals to make hand picking practicable; nor was there sufficient "waste" mixed with it to pay for sorting out, but this clay and kaolin were more or less rich in finely disseminated tin mineral.

It was obvious that the clay was bound to entail difficulty in several ways; making the ore sticky and difficult to crush in the rock breaker, rendering it impossible to use automatic feeders advantageously, reducing the duty of the stamps and tending to make the discharge of the batteries irregular by choking the screens.

I therefore suggested that the remedy for this state of things would be to eliminate the clay from the quartzose matrix of the ore before delivering it to the battery, by dumping the ore, after hoisting, on a grizzly, and washing it with a jet of water.

This freed the larger lumps remaining on the grating from clay, and they could be discharged direct from the grizzly into a rock breaker, where they were crushed to nut size (1 to 2 in.), the product of the breaker falling into a bin whence it was trammed direct to the battery.

The material passing through the grizzly, consisting of mine fines and clay, was washed down an inclined plane into a revolving sieve, furnished with knives on the interior, to disintegrate the clay and separate the ore from it; and the oversize of the trommel, consisting of hard gangue too large to pass through the screen on the drum, fell into a small bin, and was trammed to the stamps.

The material passing through the revolving sieve consisted mostly of clay mixed with fine ore, which did not exceed in size the ore discharged from the battery, a matter regulated by using a sieve of corresponding mesh, and flowed down the launder to the elevator in front of the stamp battery, whence it was lifted with the battery pulp to the classifiers to undergo dressing.

This scheme, it will be seen, was practically the same in main outlines as that described by Mr. Killik; and I am glad to learn that it has proved so successful in his case.

*Discussion of a paper by F. A. Killik entitled "Notes on a Simple Method of Separating Rock from Stiff Clays," Bull. 88, I. M. M.

†Mining engineer, 11 Queen Victoria St., London, England.

[1]Eng. and Min. Journ., Feb. 10, 1912.

Method of Driving in Heavy Ground

In driving in the new Langi Logan mine, in Australia, trouble was experienced from the pressure exerted by the swelling of the ground when exposed to the air. About 350 ft. of this ground was driven through in the following manner. The first object was to exclude the air. This was accomplished by cutting the drift larger than usual. A layer of finely crushed rock was then laid in the bottom of the drift on which 12-in. sole pieces were bedded. When the sets were put in fine sand was continued up the sides, as shown in the accompanying illustration from the *Australian Mining Standard*, to form a packing 12 in. thick between the lagging and the walls of the drift. The whole was then double lined with 12-in. timber.

Sealed Drift to Prevent Slacking of Walls

The next step, and probably the most important of all, was to open out from the side of the main drift and then turn and drive two small relieving drifts parallel to the main drift, and about seven or eight feet away. These drifts were afterward shored up with firewood. The drift at this point and throughout has been standing for over three months without showing the slightest sign of crushing.

Details of Metallurgical Practice

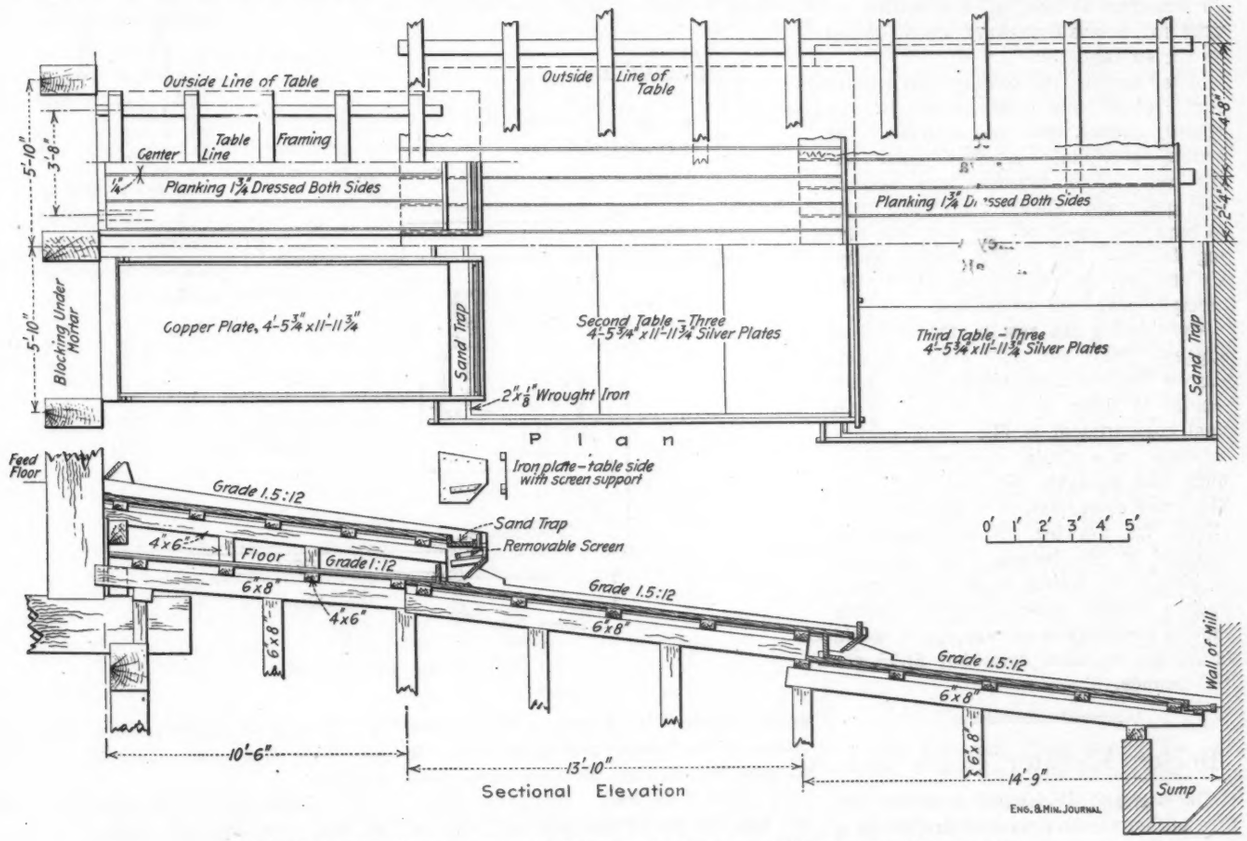
Records of Experience in Ore Dressing, Cyaniding and Smelting

Homestake Amalgamation Tables

The most notable characteristic of the stamp mills of the Homestake Mining Co. in South Dakota is the enormous total area of the amalgamation plates. The company is operating six mills in which there is a total of 1000 stamps. The arrangement of the plates is not the same in all the mills, but the most approved installation is that at the Amicus mill at Lead, which is shown in the accompanying illustration. The three sets of tables shown in the drawing are situated in front of the batteries and are within the mill building proper. After flowing over these tables the pulp passes to the "plate house" where it flows over a fourth set of tables. It is especially to be noted that no narrow sluice- or tail-plates are used; the plates of all the lower tables are wider than the first or battery plates.

The pulp from each battery of five stamps is thrown out upon a splash board whence it runs over the plain-copper plates of the first table which is 4 ft. 5¾ in. wide by 11 ft. 11¾ in. long. A sand trap and removable screen are built in the lower end of the first table. The streams from two of the first tables or from 10 stamps unite at the head of the second table. There is one of these tables for each group of 10 stamps, and are 11 ft. 11¾ in. wide by 13 ft. 5¼ in. long. From the second set the pulp passes over the third set of tables of the same dimensions as the second set thence to a sand trap and through the launder leading to the fourth set of tables in the "plate house." All plates except the first set in front of the battery are electroplated with silver, the deposit of silver being about 2 oz. per sq.ft. The stamps crush the ore to pass a 35-mesh screen and the pulp consists of about 11 parts water to one of solids.

The plates are dressed once each day. The smaller tables are brushed with an ordinary whisk broom; the larger tables with floor brooms. No scrapers are used and a thick coating of amalgam is left on the plates.



AMALGAMATION TABLES IN THE AMICUS MILL OF THE HOMESTAKE MINING CO.

Clarifying Cyanide Solutions

BY CHESTER STEINEM*

Probably the two worst zinc-box troubles are: (1) the deposition of fine rock particles on the zinc from "cloudy" solutions and (2) the deposition of a zinc slime from complex zinc compounds in solution. The effect of the latter is principally to coat the zinc shavings making them inefficient, while the former not only has this effect but makes much short zinc, and a low-grade precipitate. Naturally the low-grade precipitate necessitates more time and flux in melting.

To clarify cyanide solutions, it occurred to me that the process now in use for purifying city water might be useful. This method consists essentially in adding a small quantity of aluminum alum

*Mining engineer, Mogollon, N. M.

in solution to the water to be purified; the "lime" in solution precipitates aluminum hydroxide, which coagulates the impurities in the water. The mixture is run through a settling basin where the coagulated portion is settled out. The water is then put through a special type of sand-filter to finish the work. The process is used on river water containing the minutest clay slime and the water is so purified as to be clear and practically free from bacteria.

H. W. Miller and I made experiments to determine the effect of the alum on cyanide solution. First a sample of muddy "box-heads," running about $2.25 in gold and silver, was treated with alum (about 2 lb. per ton, which is a comparatively large quantity). A voluminous precipitate immediately appeared and a slight odor of HCN was noticeable. The precipitate was allowed to settle. In less than an hour all had settled except for a small quantity which floated on the surface.

After settling, the solution was titrated for cyanide and was found to run slightly higher than the original. The settled precipitate gave a good test for zinc. The solution was assayed for gold and silver and was found to have lost about 5c. per ton. Not having facilities for a quantitative analysis at hand, the relative amount of zinc precipitate was not determined.

Considering the results, the following suggests itself for mill work: A long narrow reservoir containing baffle walls similar to those in zinc boxes. If the final compartment is filled with oakum, excelsior, or a similar material the sand-filter can probably be dispensed with. The other compartments should have facilities for drawing off the coagulated material at the bottom. An extra set of zinc boxes would do for experiment. Such a scheme, while it would probably require considerable storage space, would be cheap, as alum costs but $1.75 per 100 pounds.

Bucket Elevator Catch Box

The material discharged from the top of a bucket elevator usually drops into a catch box that leads to a chute, or when wet material is being raised, to a launder. The material is thrown or dropped rather violently on the bottom of the catch box, and the boards of which it is made are soon worn out.

To prevent this wear in elevators raising wet materials, it is the practice in some of the mills in the Joplin district to put a 6-in. board or dam across the bottom of the opening of the catch box into the launder, so that a bed of pulp or tailing is retained in the bottom of the box, which effectually prevents wear from the falling material.

Safety Device for Traveling Cranes

It frequently happens in mills that men are required to work on the bridge rail of an electric traveling crane. This places them in an extremely dangerous position, even though the crane operator has been notified to that effect, for there is always the chance of his forgetting or becoming careless.

To provide against accident in such cases, it is stated in *Power*, that E. H. Marzolf has planned a safety device consisting essentially of an automatically operated switch which reverses the direction of the motor when the crane comes within the danger zone.

With large cranes a flat bar or T-rail is often used instead of a trolley wire, and in such cases the application of the safety device is simple. Holes are drilled in the bottom rail about 15 or 20 ft. apart and through them are hung short bars about 2 ft. long. Ordinarily these are kept up out of the way, but when a man is working on the track he lets down the nearest bar to the place at which he is working.

If the crane is traveling toward him and the operator does not stop it before coming to the auxiliary rail, a dummy trolley wheel carried on the main trolley staff will make contact with the rail. This closes the circuit through a solenoid which throws a double-throw double-pole switch and reverses the polarity of the armature. A diagram of the connections is herewith shown.

A resistance is placed in series with the armature to prevent damage to the latter from the sudden rush of current. A red light is in series with the solenoid so as to indicate to the operator what has happened.

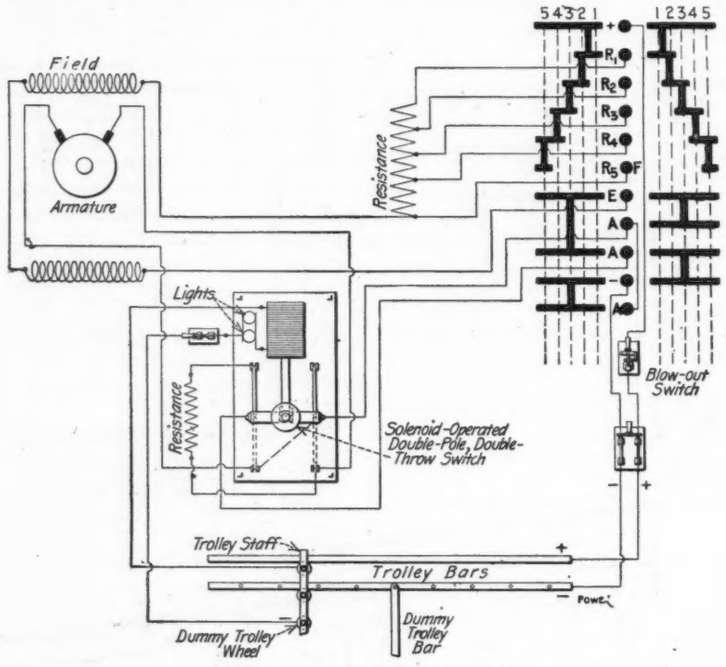


DIAGRAM OF CONNECTIONS

Gold Absorption by Mills

A brief enumeration of some of the sources of shortage in the first month's output of a modern mill is given by H. A. White (*Journ.* Chem. Met. and Min. Soc. of South Africa, Jan. 1912). There is some concentration in the mortar box itself. The launder to the elevating plant picks up a little gold in any small crevices; the tailing wheel or pump, especialy the former, has been known to gather a rich coating; the tube mills have been known to yield as much as 500 oz. of gold upon removal of the lining. Besides the amalgamation plates, the succeeding launders and traps will not yield their full share to the first cleanup.

If in addition it is considered that all the rock crushed cannot be completely treated in the crushing period, that a fair amount of gold is in the working solution, that a large amount of partially coated zinc must be left in the extractor boxes, that new furnaces and pots absorb some gold, and that some valuable byproducts formed are not immediately treated, it is clear that the usual statements to shareholders after a first month's run are considerably more than mere soothing syrup. A considerable capital is necessarily locked up in this way, though it is seldom provided for when estimating on the cost of a mill and required working capital.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Ore Extraction at Detroit Copper Co.

The report of the Detroit Copper Mining Co. of Arizona, gives an interesting comparison between the costs of extracting ore by the various systems introduced in its mines since 1907. Up to that date square setting alone was practiced.

Slicing System: The figures show that 90.55% of the tonnage now being mined, by the slicing system, is done at a cost of only 81.6% of the cost of extracting by the square-set and fill method, and that the consumption of timber by this method is 9.03 bd.ft., compared with 10.19 bd.ft. per ton of ore in square setting.

Gopher-and-Fill System: While only 0.35% of the tonnage was mined by this system it is shown that it is 51.7% cheaper than the square-set and fill method. The timber used per ton of ore, only amounted to 1.8 board feet.

Block-Caving System: Next to the gopher-and-fill systetm, block caving is indicated to be the cheapest method of extraction, 2.74% of the ore stoped was mined by this system. The cost is shown to be only 54.8% of the cost of square set and fill, while the timber required per ton of ore is just slightly above the gopher-and-fill system. The consumption as shown is 1.85 bd.ft. per ton of ore.

Underhand Square Set and Back Filling: About 2.17% of the tonnage mined was taken out by this system, the cost was 127.1%, compared with square set and fill at 100% as a basis. The timber used by this method averaged 14.99 bd.ft. per ton of ore, which is the highest consumption shown.

Total Timber Consumption: Including timber used in development, the consumption per ton of ore in 1906 was 17,518 bd.ft., the figures for 1911 show that only 9.75 bd.ft. were used per ton of ore, a reduction of 44.3% in the use of timber.

Trenching at Cobalt

At the Nipissing mine, in the Cobalt district, Canada, prospecting for vein outcrops has been carried on extensively by surface trenches. During a three-year period, 91.9 miles, or 485,232 ft. of trenches have been made by the company, as shown by its annual reports.

The average depth of the trenches in 1908 was 4.1 ft.; in 1909, 3.4 ft.; 1910, 2.7 ft.; and the average depth of all work during that period, 3.37 ft. Assuming an average width of 2 ft. would give 6.74 cu.ft. per linear foot of trench. All the work was done with an average of 78 men during working seasons, equaling 18½ months. Allowing a total of 500 working days, the average day's work was about 970 linear feet, or 6537 cu.ft. of trenches. This would indicate that the average work per man on trench work under similar conditions should be approximately 12.5 ft. of trench, averaging 3.37 ft. in depth, or about 84 cu.ft. The average cost per foot of all the trenching was 23.2c. in 1908; 15.2c. in 1909; and 13.9c. in 1910. The average cost of the 91.9 miles was approximately 17.3c. per foot.

Machine Drilling at Alaska-Treadwell

The data given in the accompanying table are derived from the report of the Alaska-Treadwell mine for the fiscal years ended May 15, 1907 and 1911.

MACHINE DRILL DATA, ALASKA-TREADWELL MINE

	1907	1911
Footage drilled during year	....	920,545
Tonnage broken	....	1,021,765
Footage drilled per ton broken	....	0.90
Average machine shifts per day, in ore	36.08	39.28
Average machine shifts per day, in waste	0.71	4.59
Average machine shifts per day, total	36.79	43.87
Average tons broken per machine shift	34.21	32.74
Average footage drilled per machine shift	36.16	29.42
Cost per machine shift:		
Labor	$6.91	$6.86
Explosives	3.05	2.62
Supplies, power, repairs, etc.	4.13	4.02
Total	$14.09	$13.05
Rate of drilling per machine shift, feet:		
Stoping	....	27.8 -34.3
Station cutting	....	33.0 -43.9
Raising	....	25.1 -35.6
Drifting	....	28.3 -42.7
Tonnage broken per machine shift:		
Stoping	....	32.49-45.59
Station cutting	....	4.28-28.32
Raising	....	4.02-10.70
Drifting	....	4.88-15.23

The stopes in this mine are from 50 to 60 ft. wide, which probably accounts for the high tonnage broken per foot of hole drilled.

An average of 1 ton was broken for 1.07 ft. of hole drilled. During the year 1911 no work was done in the opencut. The records for 1907 show that an average of 72.2 tons was broken and 44.31 ft. drilled per machine shift in the opencuts. Machine drillers are paid $3.50 and helpers $3.25 per day. During the year 1907 machine drillers working in the opencuts were paid $4.50 per day. The rock is of medium hardness.

Copper Queen Unit Labor Costs

At the Copper Queen in Arizona an average of one man is employed underground for every 400 annual tons mined, and for the total men employed in the mining department, the average is about one man for every 330 annual tons mined.

The hospital department employs one man for every 112 men employed in other departments.

The store department has one man for every 12.1 men employed around the works.

Miscellaneous work requires one man for every 28,250 annual tons treated.

The average number of employees in all departments is, one for every 227 annual tons treated at the reduction works.

In the reduction works at Douglas one man is employed for every 895 annual tons treated. The labor is divided as follows: Unloading ores, fuel, flux and supplies, one man for every 19,700 annual tons; sampling, one man for every 17,300 annual tons; smelting, one man for every 2950 annual tons; converting, one man for every 2960 annual tons ore, or 1 man for about 5200 annual tons of matte treated; power plant, one man for every 23,500 annual tons; mechanical department, shops, repairs, and construction, one man for every 4030 annual tons; office, laboratory and engineering, one man for every 23,500 annual tons treated.

Data on Mining in India

The Ooregum Gold Mining Co., situated in the Province of Mysore, India, has been operated since about 1888. The reports issued by the company show that the percentage of waste discarded from the rock hoisted is about 10.7%. The average tons of unsorted ore produced annually per man employed are approximately 29.4 tons, and the average tons of sorted ore 26.2 tons. Of the 4600 men employed at the property when the report was issued, only 96 were Europeans, the remainder were nearly all coolies, 66% of them working underground. On this basis the annual tons mined per man employed underground is 44.5 tons of unsorted ore. During this period only one foot of development was done for every 9.25 tons of unsorted ore mined, of which 27.2% was sinking.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

A Combined Hydraulic Mining and Dredging Plant

A hybrid between dredging and hydraulic mining is described by Charles Janin (*Bull.* A. I. M. E., Mar., 1912). The Blue Gravel hydraulic mine, at Smartsville, Calif., was an early-day producer, but was shut down by the Débris Commission. The Tarr Mining Company will attempt to satisfy the law as follows:

The gravel bank will be hydraulicked to a sump in front of a stationary dredge building of concrete and sheet iron, where a regular steel-girder dredge ladder, equipped with 52 seven-foot buckets elevates the gravel to a trommel 45x6 ft., with ½-in. holes. From the screen the undersize flows to gold-saving tables with Hungarian riffles having an approximate area of 4600 sq.ft. The oversize passes to a belt conveyor 570 ft. long, in two sections, each operated by a 50-hp. motor. A 100-hp. motor is used on the digging ladder, and a 30-hp. motor on the trommel. At the end of the belt-conveyor stacker two Bleichert tramways are being constructed to afford a larger dumping ground for the tailings.

The fine material, after passing the gold-saving tables, goes through a tunnel about half a mile long, and is elevated to revolving screens, the oversize going to the tailings dump, the undersize to Overstrom tables. The idea is to save the black sand, with any accompanying gold and platinum. The concentrator stands several hundred feet from the Yuba River, and a concrete dam will be constructed to give a settling basin for tailings. If this experiment is successful, it will undoubtedly mean that other properties will be operated in the same way.

High Potential Transmission in South Africa

The British South Africa Co. has under consideration a 600-mile, 150,000-volt transmission line from a 60,000-hp. turbine-generating station at Victoria Falls in Rhodesia to the Witwatersrand. In order to enable the plant to be operated continuously at full load and consequent high efficiency (*Power;* Feb. 27, 1912), a pumping station is contemplated on the Crocodile River, only about 100 miles from Johannesburg, where there will be motor-driven pumps installed. During periods of light load on the main station these will be operated by the surplus power from the turbine station to store water in a large reservoir to be built on the adjacent hill. During periods of peak load, auxiliary dynamos will be operated by this supply of stored-up water. To provide against interruptions of the system by shutdown of the water-power plant, it is also proposed to build a 20,000-hp. auxiliary steam plant about 100 miles from Johannesburg.

Lactic Acid for Cleansing Filter Leaves

At the Colburn-Ajax mill, in Victor, Colo., a new method for treating filter leaves is in use. The process consists (*Met. and Chem. Eng.*, April, 1912) of the use of lactic acid instead of the hydrochloric acid commonly employed.

The use of hydrochloric acid for dissolving the calcium compounds which collect on filtering mediums has some disadvantages. The fibers of the filtering medium are rendered hard and stiff and are completely destroyed in time. Troubles in handling, high transportation charges, freight and dues on return of empties, breakages, etc., also the fact that the commercial acid of 20° Bé contains less than a third of true hydrochloric acid, make the final cost excessive. No practical method for economically regenerating this acid, after being used, has thus far been brought forward. Further, sulphuric acid which forms calcium sulphate on the filter leaves is always present in commercial hydrochloric acid.

It is claimed that lactic acid is as effective as hydrochloric in dissolving the incrustations and that it renders the fibers of the filtering medium soft and pliable, thereby giving it greater efficiency and longer life. A 10% solution of lactic acid at a temperature of 150° F. is said to give excellent results.

Lactic acid being non-volatile and non-corrosive is transported in barrels at ordinary freight rates. It costs at the factory slightly more than hydrochloric, but this is more than offset by lower transportation charges and no return freight on empty carboys. Further, lactic acid contains no sulphuric acid. Finally, lactic acid can be regenerated for re-use from calcium lactate in the following simple manner:

The apparatus for regenerating the lactic acid consists of a sulphur-burning furnace, an air blower and pipes connecting the furnace with a perforated pipe placed at the bottom of the acid-treatment tank. The regeneration is accomplished as follows: The furnace is charged with ordinary sulphur, the latter ignited and the sulphur fumes forced through the calcium-lactate solution, by means of the air blower, until all of the calcium is precipitated, while the lactic acid is thereby regenerated. In practice it is stated that 3 lb. of lactic acid are regenerated with a consumption of less than 1¼ lb. of sulphur.

At the Colburn-Ajax mill it is found convenient to remove a single leaf of the filter whenever it becomes necessary and give it a simple scrubbing with a 1% solution of lactic acid at ordinary temperature and then replace the leaf in the basket. In view of the small amount of lactic acid used and the low freight rates to Victor, regeneration of the lactic acid is not practiced at this mill. The patents for this process are owned by the Moore Filter Co., 170 Broadway, New York.

Utilizing Storage Battery Sludge

The sludge of lead peroxide and sulphate which collects in course of years in storage batteries has a value in view of its lead content; but, according to the *Zeitschrift für Electrochemie,* its transport to lead smelteries has been costly and difficult on account of the associated acid. Washing and pressing are out of the question mainly on account of the extremely fine state of division of the peroxide. According to a German patent (No. 236,343) these difficulties are overcome by mixing the sludge with slaked lime. The resulting mixture quickly sets to a firm cake. An alternative plan is to mix the sludge with the sulphite liquor from sulphite cellulose works, the lead peroxide being thus reduced to lead sulphate. Molasses may also be used for the reduction of the peroxide. In all these reactions so much heat is set free that much of the water is evaporated.

Titanium Chloride Test for Gold

Titanium chloride may be used for the detection of gold, according to Stähler and Bachran (*Journ. Soc. Chem. Ind.,* p. 1261, 1911). When a few drops of the aqueous solution of titanium chloride are added even to an extremely dilute solution of gold chloride an intense violet coloration is formed. One part of gold in 30,000,000 parts of water may be thus detected.

A New Type of Gravity Plane

By J. J. Smith

A cable, one end hooked to the loaded cars, passes around drums, thence down the incline to the empty cars which are pulled up by the descending load. In order that loaded cars may descend always on the same track and empties ascend on the other, a novel device is used to throw the short end of the cable to the head of the loaded-car track at the end of every trip.

Self-acting or gravity planes are commonly used in transporting the output of mines from the sides of the mountains down to the valley below. Their merits are so obvious, as to need no comment but in some cases the design is such as to call for more labor for operation than seems to be desirable.

There are several types of self-acting planes, three of which are:—

(1) That in which the material is dumped into a car that runs on the incline exclusively and from which the material is transferred to other cars or to bins at the lower end of the incline.

(2) That in which a platform car receives mine cars from the mine tracks at the upper level and delivers them to other tracks at the lower level.

(3) That in which the mine cars themselves are sent down the incline loaded and brought back empty, precisely as they are on any other portion of the track, but through the operation of a rope instead of a motor of some standard haulage type.

Where the material is sticky or difficult to handle, or where it is friable and breakage is to be avoided, the first type is not desirable as it involves two handlings of the material.

The second type is objectionable on account of the difficulty of placing the platform car at top and bottom so as to make the rails on the platform register accurately with those of the stationary tracks; also on account of the difficulty of locking the cars on the platform securely and conveniently at the top and releasing them easily at the bottom.

Double Track Inclines Preferable

It is, therefore, the third type which is most commonly used and with which this article deals. This type may be subdivided into three varieties known respectively as the two-rail, three-rail and double track planes. In the first case a single track is used except at the middle of the plane, where a piece of double track must be provided with automatic switches to let the loads go down one side of the double track and the empties up the other.

The second variety has two tracks, but the central rail is common to both, except at the passing place in the middle, where the central rail branches into two separate rails far enough apart to permit the passage of the cars. This does away with the necessity for frogs and automatic switches and is, for this reason, decidely better than the two-rail plane. Both of these are open to the objection that the car does not travel in a straight line from top to bottom, but has to turn out of its course and return to it in entering and leaving the central passing-tracks. This is objectionable for the reason that derailments are much more likely to occur at such points than on straight tracks, and what is more important, the rope cannot travel in a continuous straight line down a set of narrow rollers, but is swung out of its course and back again when the car enters and leaves the passing space.

The third variety has two separate and distinct tracks running in an unbroken straight line from top to bottom.

The problem of proper maintenance of good rollers is more important than any other, except the problem of labor cost, on the self-acting plane, and for this reason I have always preferred the comparatively small additional expense of the two-track or four-rail plane to the slight saving in first cost to be made by the use of the two- or three-rail planes. It is for this reason that the incline to be described is of the double-track type, though it is probable that it could also be adapted to the other types, if that were desirable.

The ordinary type of four-rail plane, in which cars are attached to each end of the cable, requires much track room at the head and also at the foot for gathering- and sorting-tracks. Calling the two sides of the plane *A* and *B*, when a trip of loads is sent down *A*, a trip of empties is brought up the other side, *B*. Next a trip of loads must be sent down track *B* and a trip of empties brought up track *A*. This means that both loads and empties are handled on both tracks and in order to sort these out it is necessary to have, not only the storage tracks for loads and empties at top and bottom, but a system of double cross-overs so that the loads from the loaded-car storage track at the top can be delivered to either side of the plane

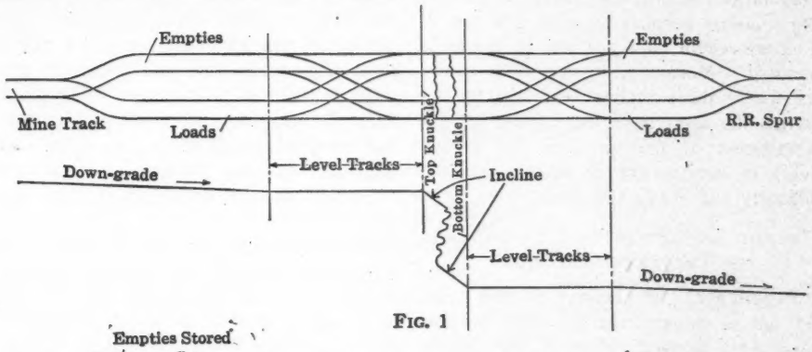


FIG. 1

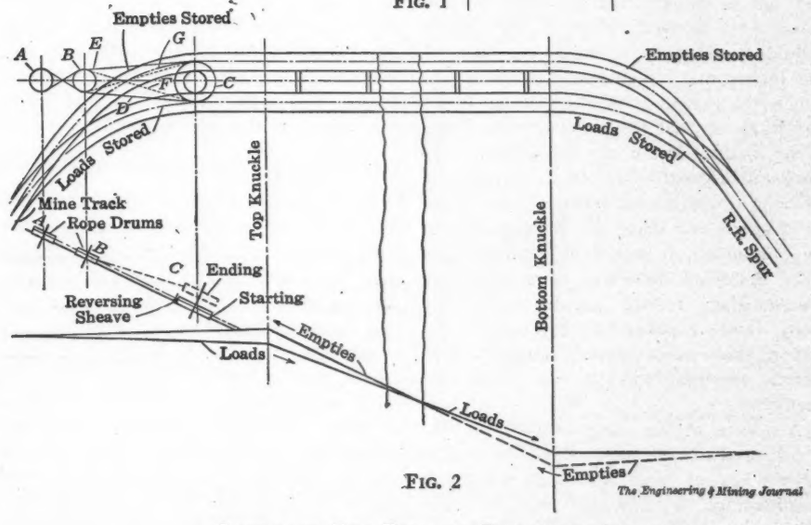


FIG. 2

LAYOUT OF TWO TYPES OF TWO-TRACK INCLINES

and from either side of the plane delivered again to the loaded-car storage track at the bottom, with an exactly similar arrangement for taking the empties from the empty-car storage tracks at the bottom. In Fig. 1, the necessary tracks to do this are illustrated diagrammatically.

It will be seen that in all four cross-overs and two 4-frog crossings are required, and this in turn involves a sufficient amount of level track to install these at top and bottom. This track must be level or have just sufficient grade to equalize the labor of handling the loads down and the empties up this grade, because cars must be handled continually in both directions over both sets of tracks.

This always means expensive hand tramming at both top and bottom of the incline, and unless the tonnage is very large the necessary labor to handle the smallest permissible unit will run to a considerable cost per ton of material handled. Moreover, in the hilly country where these inclines are usually installed the level space necessary for the installation of the switches and cross-overs is not always obtainable without difficulty and heavy expense.

Traffic on Either Side Should be in The Same Direction

Experience with inclines of this type led me to believe that if some means could be devised whereby the loads would travel always down one side of the incline and the empties always up the other, the grades could in all cases favor the traffic so that the cars, whether empty or loaded, would run by gravity with consequent great reduction of the amount of hand tramming necessary. Also if the dead space necessary for the cross-overs be eliminated, it would still further reduce the hand tramming necessary, and would also reduce greatly the difficulty and expense of getting a location that would permit suitable terminals for the top and bottom of the incline.

A glance at the tracks shown in Fig. 2 will convince the most skeptical of the advantages of such a design whatever disadvantage he may believe it to have in practice. There is simply a single switch at the top and one at the bottom through which the traffic always passes the same way when going in the same direction so that spring switches may be used still further to simplify the operation.

It will be noted that in Fig. 2 the incline for loads starts at a little lower elevation and stops at a little higher elevation than that for the empties, and, therefore, the empties are raised by the incline through a slightly greater height than that through which the loaded-cars descend. This difference seems greater in the sketch than it really is, because the main portion of the incline, where the tracks are at the same level, is broken out to save space. Actually there is needed only a difference of two or three feet at each end to secure gravity shifting of both loads and empties for any reasonable amount of storage. The amount actually required for any given case is simply twice the easy-running grade for the given conditions multiplied by the length of storage track necessary.

Cable Difficulties

If these advantages were not offset by some correspondingly great difficulty this type of plane would have been in universal use from the earliest days of railed tracks. The difficulty will be obvious to anyone familiar with such matters. It is that with the ordinary arrangement of rope drums, etc., each car would run over the rope leading to the other car every trip and that the ropes would pull diagonally from the head of one track to the foot of the other every other trip. In other words, on every alternate trip the ropes must cross. To avoid this difficulty was the problem the solution of which is the only excuse for this article.

It is true that the ropes must cross somewhere because they must go from a definite point in the center line of one track over to a point in the center line of the other track every other trip if they are to fulfill the primary condition for successful operation that the ropes must travel in a straight line up and down the center of the incline tracks.

Cable Shifted by a Reversing Sheave

But there is no objection to the crossing of the ropes if they do so at some point above the travel of the cars on the incline. Therefore, if, between the two ropes a sheave be inserted approximately the same diameter as the distance between the centers of the two incline tracks, and if the two ropes on one trip run in straight lines from their drums up or down the center of their respective tracks just touching the sides of this sheave, and if, before the next trip, this sheave be turned over laterally so that its bottom side will be on top, each rope will be thrown over to the center of the opposite incline and the problem will be solved.

The ends of the ropes at top and bottom are carried across from the tracks they have just traveled over to those opposite and are hooked to their respective trips on those tracks. Another trip is then run, the sections of the rope being held in the center line of the tracks by the reversing sheave until the trip is completed. The sheave is then turned half over again, but in the opposite direction of rotation so that the ropes are restored to their orginal position. Each rope, in turn, thus takes down a loaded trip on the loaded-car track and brings back an empty trip on the empty-car track. In Fig. 2, this is illustrated diagramatically.

In the actual installation, to be described later, as in several others, the type of rope drums used was what may be called the "figure 8" type, consisting of two drums or sheaves with four or five grooves in each, set one behind the other, a half-groove width out of line with each other. The rope then winds a half or three-quarters turn around each sheave and runs to the next groove in the other sheave, and so from one drum to the other until the grooves are filled.

This is a well-known type of twin drums for self-acting planes and has the advantage of requiring only a length of rope equal to one length of the incline, plus the length wrapped around the drums, and that the drums themselves are small and inexpensive, whereas, if a drum be used large enough so that each half of it will contain the rope for one track of the incline, it requires almost twice as much rope and much larger and more expensive drums. Moreover, with this type of drum the lower end of the rope is worn out much more rapidly than the upper end, whereas, with the figure-8 type the whole length of the rope is worn about equally.

These drums, being small and light, are set so that their plane is approximately a prolongation of the plane of the incline. This causes the rope to wind on them without guide sheaves which is a desirable arrangement. These rope drums are indicated as *A* and *B* in the diagramatic sketch, Fig. 2. The sheave for shifting the ropes from one incline to the other is called the reversing sheave, indicated by *C* in the sketch, and lies in the same plane as the other two. The position of the ropes is indicated for one trip by the letters *D* and *E*. In this case the ropes just touch the sides of the reversing sheave and run in the center of the incline tracks in line with the sides of the drum *B*, which winds and unwinds them. On the next trip their positions are shown by the dotted lines *F* and *G*. It must be understood that the reversing sheave *C* is turned over not in the sense of a half revolution each time, but in the same way that a dinner plate would be turned upside down and back again.

Reversing Sheave Carried on an Invertible Frame

The questions will at once arise in the minds of all as to how is it possible to support the reversing sheave *C* without either of the ropes fouling its supports in passing back and forth, and as to how is it possible to turn it upside down and back without more labor than

is involved in shifting the cars by hand. The answer to the first question is, by supporting the frame of the reversing sheave not on a central pedestal, but on a ring surrounding it and large enough for the ropes to pass through without touching. The answer to the second question is, that the lowering of the load supplies power for this purpose, if convenient means can be found for applying it. The drawing, Fig. 3, shows the details by which both objects are accomplished.

In Fig. 4 is shown the framework supporting both the rope drums and the reversing sheave, all on the slope on which they were actually used at a certain installation. The incline is to the left with the knuckle some 20 or 25 ft. away, so that the center of the reversing sheave is 8 or 10 ft. above the ground and the cars run under the framework which supports it.

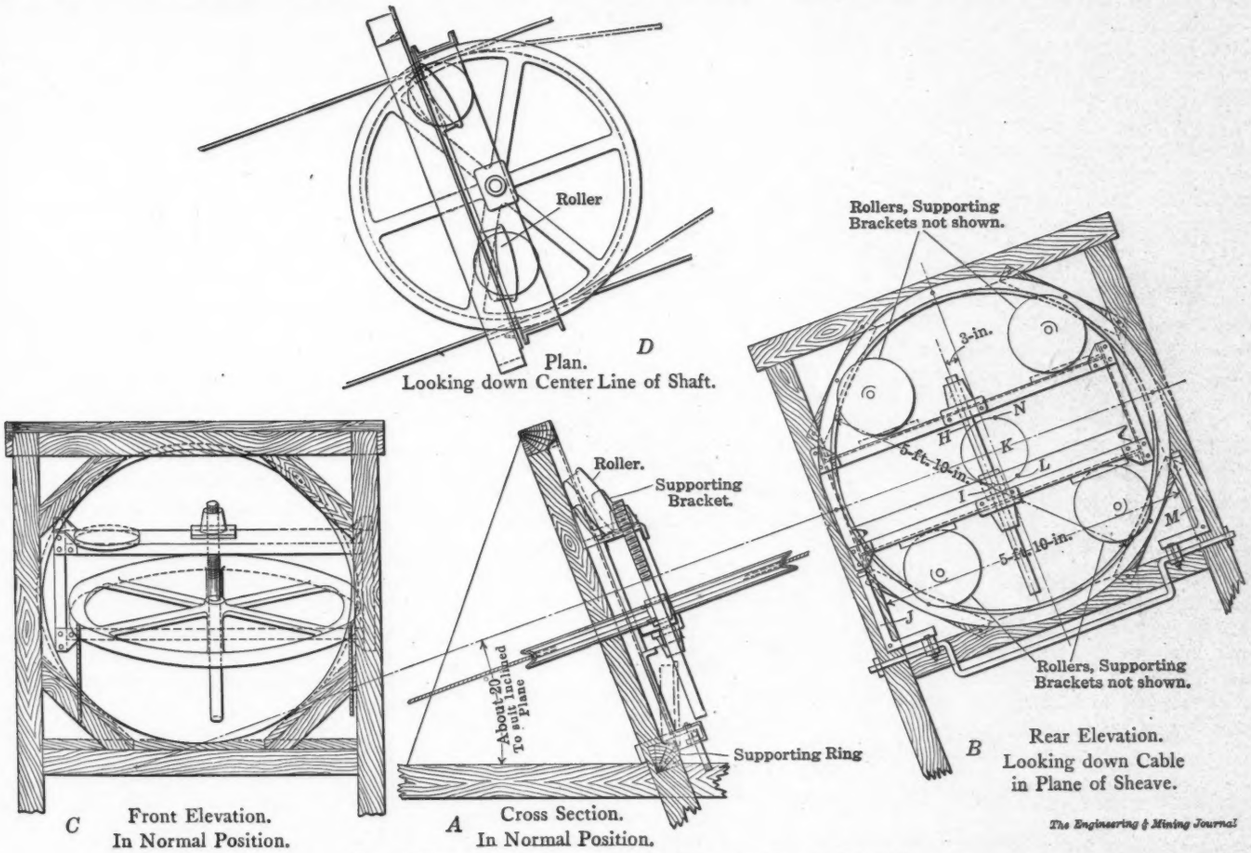


FIG. 3. DETAILS OF AUTOMATIC INVERTING GUIDE SHEAVE

DETAILS OF THE REVERSING SHEAVE

In Fig. 4 *A* may be called an inclined plan, looking down normally upon the sloping plane in which the drums and reversing sheave lie. *B* is an inclined rear elevation showing the reversing sheave in its frame, looking down the sloping plane with the rope drums removed. The details of the construction of the reversing sheave in its supporting ring and rotating frame are best shown by Fig. 3 where *A* is a central section; *B* a normal rear elevation; *C* a vertical front elevation, and *D* an inclined or normal plan.

The reversing sheave with its shaft is clearly shown. It is supported in a rectangular frame of structural steel which carries on its exterior surface four rollers mounted in suitable brackets. The supporting ring is an angle section with an obtuse angle, welded and turned true on its conical face. The rollers are also conical and laid out so as to roll truly within the large cone of the ring. Of this more anon.

It will be seen that the channels which constitute the principal transverse members of the rotating frame are far enough apart so that the reversing sheave can move through a considerable distance in the direction of its axis and that one end of its shaft is threaded, this thread engaging with a corresponding thread in one of the supporting journals of the shaft.

It will further be observed that the center of the shaft is set three inches to the left (Fig. 3, *B*) of the center supporting ring. The reversing sheave is an ordinary sheave, wood filled preferred, the spaces between the arms of which are filled in with iron weights bolted together so as to make it a solid disk of the thickness of the arms. This is only for weight for a purpose which will presently be evident.

It is self-evident that if the reversing sheave were set centrally in the revolving ring the whole structure could be turned into any position indifferently with only the effort required to overcome the friction of the conical rollers, which are purposely made large and their shafts small to reduce this friction as much as possible.

As the revolving frame is balanced relative to the center of the supporting ring, it is further evident that the location of the center of the sheave controls the location of the center of gravity of the structure as a whole and that in the position as drawn, the center of gravity is three inches to the left of the center of the revolving frame, and about six inches below it.

POWER FOR INVERTING FRAME SUPPLIED BY DESCENDING LOAD

Assume that this is the condition of things at the beginning of a trip and that the pitch of the screw shaft of the reversing sheave is such that the revolution of the latter by the movement of the cars brings it at the end of the trip to a corresponding position *H* above the center which is six inches above the center of the revolving ring (which, of course, is also the center of rotation of the structure) and three inches to the left of it. The weight of the reversing sheave being about 1200 lbs. it is obvious

that the structure will not stay in this position without being held there, for which purpose the latch *J* is provided.

If now this latch is removed from under the end of the revolving frame, the structure as a whole will swing exactly as if it were a pendulum with its center at the center of the supporting ring *K* and its weight raised up to the position *H*, and that when released it would go beyond the center to as great a height on the opposite side, except for the friction required to move it, but, in any event, to a considerable distance beyond point *L* diametrically opposite to *H*. In doing this the projecting end of the structural frame pushes aside the opposite latch *M*, and after it has gone as far as its inertia will carry it drops back again as any other pendulum would do until it is caught by the latch *M* on its way back.

The whole structure is now exactly upside down from what it was at the start. The sheave is again six inches below the center, but its axis is three inches to the right of the center instead of to the left, as before.

On the next trip of the cars the sheave is revolved in the opposite direction (as the rope travels the opposite way) but as the screw has been turned upside down, rotation in the opposite direction raises it again. This may not be apparent at first sight, but it is easy to assure ones self that it is correct by considering that if the direction of the rope travel were reversed without the sheave having been turned upside down, it would have traveled downward, of course. But as the whole structure has been turned bodily upside down, what was downward before becomes upward now. Therefore, on the next trip the center of gravity of the sheave travels from the position *L* vertically up to the position *N*, and at the end of the trip, if latch *M* be released, it will make exactly the same pendulum movement as before passing its initial position *I*, throwing aside the latch *J* and be stopped by the latter on its return to its initial position *I*. The next trip sends it up to *H* and on release it goes once more to *L*. Thence on the following trip to *N* again and so on. The supporting ring is made large enough so that the ropes leading from the sheave pass through it without touching either at the top or bottom of their travel.

The desired object is thus accomplished. The loads run always on one track; they run down hill to the top of the incline and down hill away from the bottom of the incline. The empties run by gravity to the foot of their incline and by gravity away from the head of their incline. The loaded-car rope always travels straight down the center of its incline. The empty rope always starts with its end and upper portion on the opposite track from that on which the major portion of it lies, but this is straightened out as soon as the strain comes on the rope and without its dragging. The means by which this latter is accomplished will later be specified in detail.

It may be well to explain here that two of these inclines were built with different working angles, and in the latter some minor changes were incorporated to overcome slight defects found by experience in the first, which however, did not interfere with its successful operation. Fig. 4 was the design made for the first of these, Fig. 3 for the second, hence the slight differences between the two.

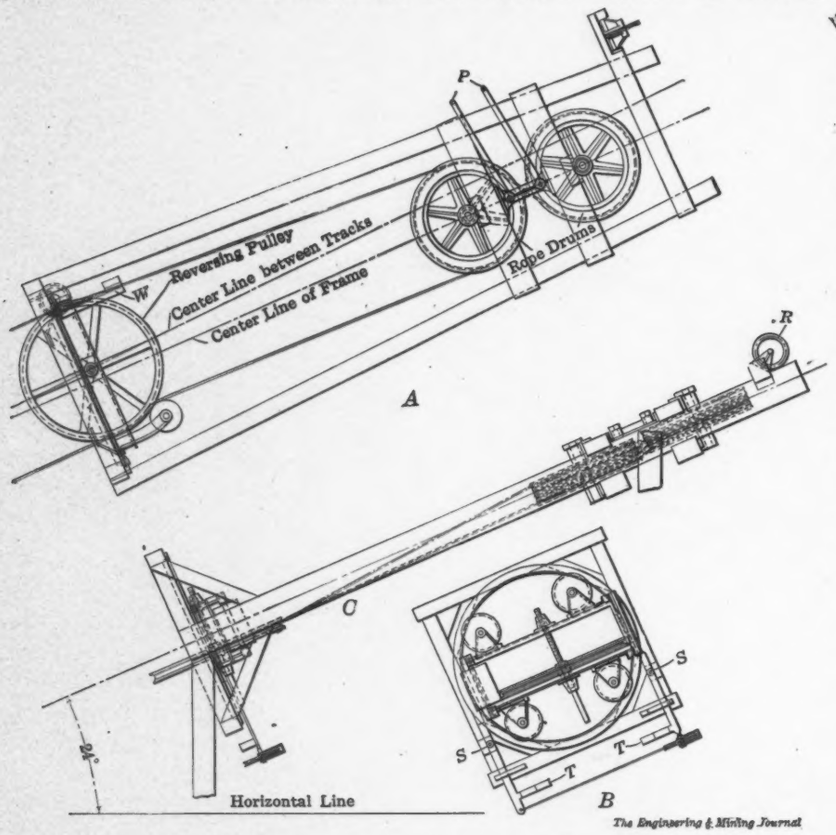


FIG. 4. GUIDE-SHEAVE AND BRAKE-DRUM STRUCTURE

CONICAL RING UNSATISFACTORY

Particular attention must be called to the conical ring with its surface approximately horizontal at the bottom, because this design was adopted with the idea that it would prevent the flange of the rollers from bearing too heavily on the face of the ring at the top of their travel and so make it turn more easily. This involved the use not only of the conical ring, which was more difficult and expensive to make than a cylindrical one would have been, but also the use of conical rollers all mounted at a double angle in space on the structural frame which constituted a difficult piece of laying out for the draftsman and crooked construction for the mechanics. When it was completed it was found that not only the structure as a whole tended to slide out of the supporting ring at the bottom, but that it tended to tip away from it at the top, though it was supposed that the center of gravity would always be within the ring and that this would not happen. This made it necessary to provide small flanges on the inside of the supporting ring, which were a nuisance and increased the friction of operation.

A more careful analysis of the forces involved eventually showed some conditions into which it is not necessary to go in detail further than to say that they explained the reason for the tipping of the revolving structure away from the supporting ring at the top. As a result of this discovery, too late to be of benefit in that installation, I am convinced that it is not only simpler, cheaper and easier to use a cylindrical supporting ring and cylindrical rollers set parallel with the axis of the structure, but that this construction is necessary to eliminate the two evils of sliding out at the bottom and tipping back at the top and would result in a structure that would revolve with less friction than the one shown, to say nothing of the gray hairs saved to the draftsman.

It will be obvious that in the open position of the ropes they barely touch on the sides of the revolving sheave, and as this is heavy some little pressure

against it by the rope is necessary to raise its weight by means of the screw. In the crossed position of the ropes there is, of course, contact in plenty. The result was that the sheave tended not to be screwed as far in one direction as it was in the other, with the result of working to the limit of its travel, and striking against its frame after a sufficient number of trips.

To obviate this difficulty a roller was introduced in the second design, as shown in Fig. 4, *A*, which gives the loaded rope about the same amount of contact with the sheave in the open position that it has in the crossed position, but which runs free of the rope when the latter is in the crossed position. This overcomes this trouble successfully.

By a little care this roller can also be made to serve as a counter-balance for the light end of the structural frame, which must be somewhat longer on one end than on the other for constructional reasons that are apparent from the design. The weight *W* in the same figure was intended as a counterweight to hold the frame in at the bottom, but would not be needed if the cylindrical supporting ring were used.

The drum brake levers *P* are also shown in this view. They are made separate for these drums and the brake bands are made independent, although in some designs one brake strap is connected to the other in figure-8 form, the same as that in which the ropes pass around the drums, but I do not recommend this design for the reason that if any portion of either brake strap or other connection gives way, both brakes are instantly rendered slack and useless, whereas, when both are made independent and are given independent levers, if one fails it does not affect the other, which will generally be sufficient to control the trip in safety to the bottom.

Only One Operator Required

On account of the elimination of hand tramming or shifting it is easy for one man to attend the head of these planes, hook on the cars, take off the car brakes, take hold of the band brakes and control the trip to the bottom, but in order to do so his operating station must be close to the knuckle where he can have an uninterrupted view of the trip. Safety demands that the drum brakes shall be held automatically and that the operator shall relieve them to the extent necessary for controlling the speed.

On this account there is provided a small sheave *R* (Fig 3) and a rope running from the end of the band-brake levers back over this sheave to a barrel full of rock suspended on the end of the rope. Another rope leads in the opposite direction from the levers to the operator's hand-lever whereby he can lift the weight of the barrel of rock sufficiently to relieve the brakes and control the trip, but if he leaves his position or his rope fails the weight will apply the brakes and bring the trip to a standstill.

Frame Control and Safety Devices

It is very desirable to have some means of operating the latches which control the revolving frame without the operator having to go up to them. The design in Fig. 4, *B* looks good, but was not successful in practice as there was too much inertia. Its principle is quite obvious. The latches, fulcrumed at the point *S*, were held in their vertical position by the weight of the arms *T*. A small rope passed from the lower end of one latch around a light sheave on the bottom of the other to the operator's lever, and was attached on the opposite side of the fulcrum from the brake rope, the idea being that when the latch rope was tightened the two latches would be drawn together at the bottom and the revolving frame released, whichever latch might be holding it. But the situation of the latch fulcrums *S*, as shown, involved too high an angular velocity and too much inertia in the long ends of the latches when the swing of the revolving frame brushed the latches aside. Spring-actuated latches with the fulcrum further removed from the latching point should have been used.

The arrangement of drawing both brakes together with a single movement of a single rope is a good one, and attaching this rope to the operator's lever as described enabled the whole plane to be operated with the one lever because tightening upon the brake rope slacked off on the latch rope and conversely the latch rope could only be tightened after the brake rope was slacked off and the brakes firmly set by the suspended weight.

While on this point of safety and convenience of operation it may be well to describe a simple automatic safety device which only allows one trip, or in this case, one car, to go down the incline at a time and which cannot be tied back out of operation for the convenience of the operator. This is illustrated in Fig. 5. The sketch, while rough and crude, is no more so than the device it represents, nevertheless it worked successfully.

Just above the knuckle of the loaded-car track a short post is set in the ground as a hitch for the foot of an inclined timber, the top of which is supported by a taller post. The diagonal timber is, of course spiked to both its supporting posts to prevent dislodgment under stress.

The vertical plane of this inclined timber is parallel to and a short distance from the side of a car on the loaded-car track. It supports a heavy bolt which acts as fulcrum for a revolving hook, which is shown in three positions in the plan view. This hook has a long shank projecting beyond the fulcrum in the opposite direction so that the hook end is only a little heavier than the shank. The fulcrum is normal to the line of the supporting timber and the plane of revolution of the hook is parallel to the latter.

The design and support of the hook are such that the hook end can be turned uppermost and will remain there, held by friction though in unstable equilibrium. When in this position *A*, the shank of the hook projects out slightly beyond the line of the car body. When the latter comes along it strikes this shank and pushes it away from the track. This throws the heavy hook end around beyond the range where friction can hold it, and it tends to swing clear around but the back end of the car body prevents it from doing so until the car has gone by, as shown by position *B*, in solid lines. After the car has gone by the hook swings around and comes to rest with its center of gravity at the lowest point in the position *C*. It will be seen that its point then projects past the line of the car body and that if a runaway car comes along this hook will catch it in front and low down. The inertia of the car forcing it ahead, the point of the hook holds it, swings it sideways and throws the car off the track if it is coming with such speed that the hook cannot stop it without derailing.

On account of the flat angle at which the hook works and the comparatively large friction of its hub, there is no trouble whatever in putting it into a position where it will remain inverted, so that the operator loses no time by having to set it each time, at the same time it is impossible for him to throw it out of use or get more than one car by it without re-setting it, unless he takes the hook off and throws it away.

The Work of the Operator

There may be some skepticism concerning the statement that one operator can handle the upper end of one of these inclines, but the method of operation is as follows:

A car from the string on the loaded-car track is released and brought down on its own brake to a position just above the hook. The car brake is then set, the rope shackled on, the safety hook is then set to the clear position, the car brake released and the car allowed to run forward until the slack is out of the rope, which occurs just before it reaches the knuckle. This is perfectly safe because the drum brakes are tightly set. The operator then goes to the brake lever, releases it, and the car is lowered to the bottom.

To prevent the possibility of the things which we all know cannot possibly happen, but which sometimes do nevertheless, a safety device is desirable to prevent the empty car from running back over its knuckle down the incline after it is unhooked. Of course, the grade is down from the knuckle toward the mine on the empty-car track, but if the knuckle, which ought be quite sharp, should settle a little, an accident might occur in this way. To prevent it a long oak plank was spiked to the ties just below the empty-car track knuckle in such a position that its upper end projected above the knuckle and was struck and depressed by the axles of the empty cars as they passed over it, the end standing a little higher from the track than the axles. If a car started to run down this track this heavy plank ran between the axle and the car bottom, stopping the car short.

rope delivered to it laterally. The general features of the design are roughly shown by the sketches. A wooden roller is used the top of which is level with the top rail, but the roller is coned down the next rail so that the surface of the cone clears the flanges on the car wheels. The bearing is a small casting which fastens to the bottom of the rail. It has on the inside a clip or groove, which hooks over the rail flange from below and the upward extension of this hook carries the bearing proper. On the outside it is held to the rail by a single bolt, so situated that about $\frac{1}{16}$ in. of the rail flange has to be cut away to let it in. The slight notch so made causes the bolt to lock the bearing in position lengthwise of the rail as well as hold it laterally and vertically. On the opposite end the roller extends a short distance beyond the center of the track and terminates in a cast-iron

laterally on the rollers and cannot cut into them.

Of course, if travel took place in both directions this would soon throw the rope over the end of the roller on the opposite end from the bell, but the only travel of the rope that takes place in this direction is that which occurs early in the trip when the rope is in process of being transferred bodily to the empty track, therefore, any travel in this direction contributed by the rollers is a benefit. The probabilities are that they could be set at a considerably greater angle than here shown with proportionately greater beneficial results.

The transfer rollers consist of plain cylindrical rollers set at an angle of 10 or 15° from the line of the normal to the tracks in the direction shown. A moment's consideration of what must happen when the rope rests upon them is sufficient to show that they cannot

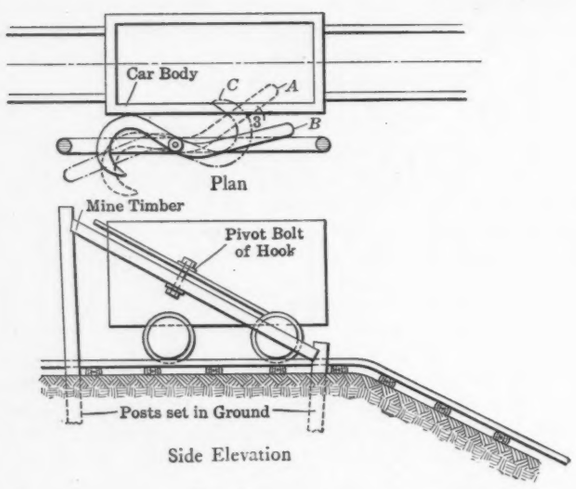


FIG. 5

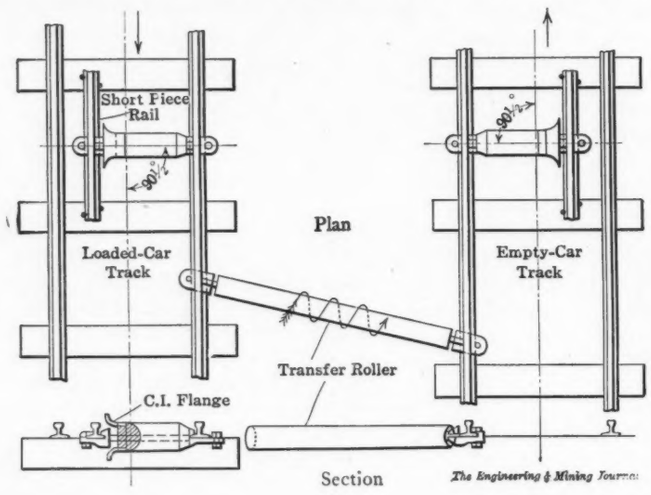


FIG. 6

SAFETY DEVICE AND TRANSFER IDLERS FOR GRAVITY PLANE

ROLLERS USED TO SHIFT THE ROPE

It is obvious that the transfer of the rope from the loaded to the empty-car track must occur at every trip, and in order that the design shall be successful in any proper sense, this necessity must be met by means which will be convenient and will prevent the dragging of the rope. Fig. 6 shows the details of the rope rollers used on the inclines and also the transfer rollers used for shifting the rope from the loaded- to the empty-car track. As the tracks run in an unbroken straight line the rope is not subject to any lateral swing, but is stretched in a straight line down the center of the incline. Because the rope must shift from the loaded- to the empty-car track it is necessary to use a type of roller which will facilitate its movement in that direction.

CONSTRUCTION OF ROLLERS

Similarly on the empty-car track the roller must be of a type to receive the bell-shaped flange. The same type of bearing is used on this end of the roller and it is supported on a short piece of rail spiked from tie to tie. This is much more substantial and satisfactory than the sloped plank spiked to the ties so often used, and is a permanent fixture.

It will be noticed that the roller stands at an angle with the center of the track of about half degree less than a right angle, measuring from the line of approach of the rope. This is not a necessity in this design, but is done to give the rope a tendency to travel like a screw thread along the roller as it runs. This carries it over to the cast-iron bell on which it alternately climbs above the angle of repose and slips back below it. This tends to prevent the rope from starting a groove in the roller and then cutting it in two. The pull on the rope tends always to restore it to the center line, while the slight angle of the roller tends always to carry it from this, with the result that the rope is always hunting

fail to transfer it from the loaded to the empty-car track, as shown by the helix indicated. The surfaces of these also are set level with the tops of the rails and their bearings can be of the same type as those for the track rollers, but they should come flush with the top of the rails, there being no necessity of providing room for the wheel flange to pass in this case. Once the rope is delivered to the empty-car track both the pull of the car and the diagonal set of the track rollers tend to carry it up the cone at the edge of the rail to the cylindrical surface of the roller and so over against the flange. Thereafter its action is precisely the same as that of the loaded-car rope. It is worth while to pay some little attention to the design of these rollers and their bearings with the object of increasing both their durability and that of the rope which they carry. On the average mine incline the rollers are in a condition not ornamental in themselves nor useful for the rope.

Money expended in making both the rollers and their bearings more substantial pays a heavy interest either in subsequent replacement avoided or in reduced wear on the rope, if they are not replaced as required.

The rollers here described were first roughed out then bored from end to end. An iron mandrel turned down to a relatively small but substantial bearing at the ends was driven through the bored hole and tightly wedged to place. They were then turned up on this mandrel, a shoulder being turned for the reception of the flange at the same time. The flange was made with its fit on the roller a diverging cone, and after being slipped into place on the roller, wedges were driven into saw-kerfs that spread the wood within the flange out into the divergent cone, which thereby secured the flange in its place for the life of the roller under ordinary circumstances.

Upper Knuckle Should be Carried on Timbers

It will be observed that the knuckles on the empty-car track are appreciably more acute than those on the loaded-car track because at the bottom the traffic is down toward the incline and then up, and at the top on leaving the incline is immediately down again, so that the direction of the grade on the approach is the reverse of that of the incline proper at both top and bottom, but on the loaded-car track this is not the case because the grade of the track is toward the incline at the top and away from it at the bottom.

In order to secure this condition the top knuckle in particular, on the empty-car track needs to be built quite substantially. It is, in ordinary cases, two or three feet higher than the loaded-car track at the same point, therefore, if made of dirt it tends always to creep away from this high point. For this reason it is as well to support the rails at this knuckle on timbers suitably framed together to give the required angle and maintain it without support from the earthwork immediately below the knuckle.

One would, at first thought, suppose that it would not make any difference if the empty and loaded-car track knuckles were not in the same vertical plane at right angles to the incline; that is to say, one of them could be a little further up or down the incline than the other without producing any objectionable result, provided the conditions were the same at both top and bottom, but this is not true for the reason that when the rope is stopped at the end of the trip, its length must be such as to have delivered the empty-cars to the proper point, while on starting the next trip down its length must also be correct for putting the loaded car in the proper position in relation to its knuckle, consequently the knuckles in both planes should be opposite each other.

The objection to the type of incline which I have attempted to describe consists in the fact that it is not possible to throw one together in a few days without surveys, plans, and almost without consideration, as can undoubtedly be done with some of the better-known types, especially where they lie on comparatively flat ground. If only temporary use is to be made of the incline it is doubtful whether the type here described is worth the thought that should be put upon its proper design and installation. If it is to be used for a sufficient period for operating costs to be a consideration, then, in my judgment, the trouble and expense necessary to make a survey of the ground and an intelligent design of the incline will be money well expended.

I do not say anything as to first cost because while the equipment of the type here described is a little more elaborate and expensive than that of the ordinary type, the amount of trackage, and above all, the amount of room necessary at the top and bottom for the various switches, etc, for the ordinary type will often more than equal the higher equipment cost of the type here described. These points must all be given due consideration and each case decided on its merits.

I do not advocate the type of incline I have described for universal use, but I know there are conditions, particularly those where the operation will be of some duration, where its installation will pay handsomely as compared with that of any other type.

General Considerations

A point too often ignored in the location and design of self-acting planes is the shape of the hillside, over which they are to work. Engineers are as prone to chose a hillside convex upward in the vertical plane as they are to choose one concave upward, if the former comes in a more convenient position, but this is, in my judgment, bad practice for three reasons:

(1) With a concave hillside it is possible to see the trip without interruption from top to bottom, and if the operator's position be chosen as described in this article, this can easily be done, whereas, if the hillside be convex, the operator loses sight of the loaded-car early in the trip and has no further information of what is going on until the empty comes in sight over the brow of the hill.

(2) The inertia of both cars has to be overcome by the gravity effect of the load at the beginning of the trip, also the whole weight of the rope on the empty side has to be overcome. For this reason the energy required is a maximum at the beginning of the trip and a minimum at its end. With a concave incline the energy is developed in this same general way, that is, most of it at the beginning and little at the end.

(3) With a convex incline the weight of the rope and the tension on it due to its load both operate to pull it hard down upon the rollers, doubling the wear on both, but with the concave incline the tension due to the load and the weight of the rope tend to swing the rope into a catenary and make its pressure upon the rollers a minimum.

Level Tracks at Bottom of Incline

I had never appreciated how far it was possible to go in this direction until a few years ago when I saw an incline, probably 300 ft. long in all, with a total drop of about 40 ft., all of which I should say was in the first 100 ft. or so, the remainder of the track being perfectly level. The incline was properly laid out, the maximum slope being at the upper end, amounting, I should say, to 30 or 35° and decreasing smoothly until the level track was reached. It will be seen that the empty car had to be brought up the steepest part of the grade when the loaded car was running on level track. When I first saw it I said to the superintendent, an old friend, that I did not see how it could possibly work, but he promptly had a trip run and demonstrated to my entire satisfaction that it not only could work, but did so smoothly and satisfactorily. The track was in good shape and the vertical curve being smooth and uniform the operator released the loaded-car so that it went away with a rush. The velocity so acquired not only took it out to the end of its travel, but also brought the empty up under the loading chute in good shape and with rapidly decreasing velocity, making its control much easier than would otherwise be the case.

From this experience and from the considerations before mentioned I am convinced that not enough attention is paid to selecting concave sites for inclines, and I believe that in many cases a stretch of level track at the bottom as an extension of the incline proper would be of distinct benefit to it from every point of view, provided the level track were joined to the slope with a smooth vertical curve.

Failure of Light Alloys

The danger of the alloys of aluminum to spontaneous disintegration has been investigated by E. F. Law (*Trans.* Farad. Soc., Vol. 6, pp. 185-198). This is apparently due to a molecular rearrangement accompanied by a marked expansion of the metal. This change can be delayed, and sometimes prevented, by chilling and working the alloys soon after making them.

The Blast Roasting of Galena

Recent exhaustive study has been made of the chemistry and physics of blast roasting, which is here summarized. An apparent forerunner of the present pot-roasting apparatus was used in Spain about 30 years ago.

At a recent meeting of the Institution of Mining and Metallurgy, C. O. Bannister contributed a paper "On the Theory of Blast Roasting of Galena," which will be a classic of its subject, revealing a wealth of careful and intelligent experimental research and settling many questions that have heretofore been in doubt.

Mr. Bannister's Conclusions

We shall here repeat only Mr. Bannister's conclusions, which are as follows:

(1) The older theories relating to the formation and subsequent reactions of peroxides, plumbites and plumbates are wrong; when these compounds are formed it is only in minute quantity, quite insufficient to affect the final results. The former theories depending on definite reactions between calcium sulphate and lead sulphide are also wrong.

(2) Later theories depending merely on the diluent effect of the various agents added are only partially true, as important chemical reactions take place in the presence of lime, limestone and magnesia.

(3) The oxidation of lead sulphide takes place in three stages, (i) its partial oxidation to a mixture of sulphate and oxide, (ii) a reaction between sulphide and sulphate, and (iii) a reaction between sulphide and oxide.

(4) In the presence of lime, limestone or magnesia, the sulphates of calcium or magnesium are formed in preference to sulphate of lead, leaving a much larger quantity of lead in the roasted material as oxide.

(5) Silica and calcium sulphate act merely as diluents, taking no chemical part in the reactions until a temperature of over 1000° is reached.

(6) Ferric oxide in certain physical states appears to act as a catalyzing agent, lowering the temperature of oxidation of lead sulphide and increasing the amount of lead sulphate formed during the roast.

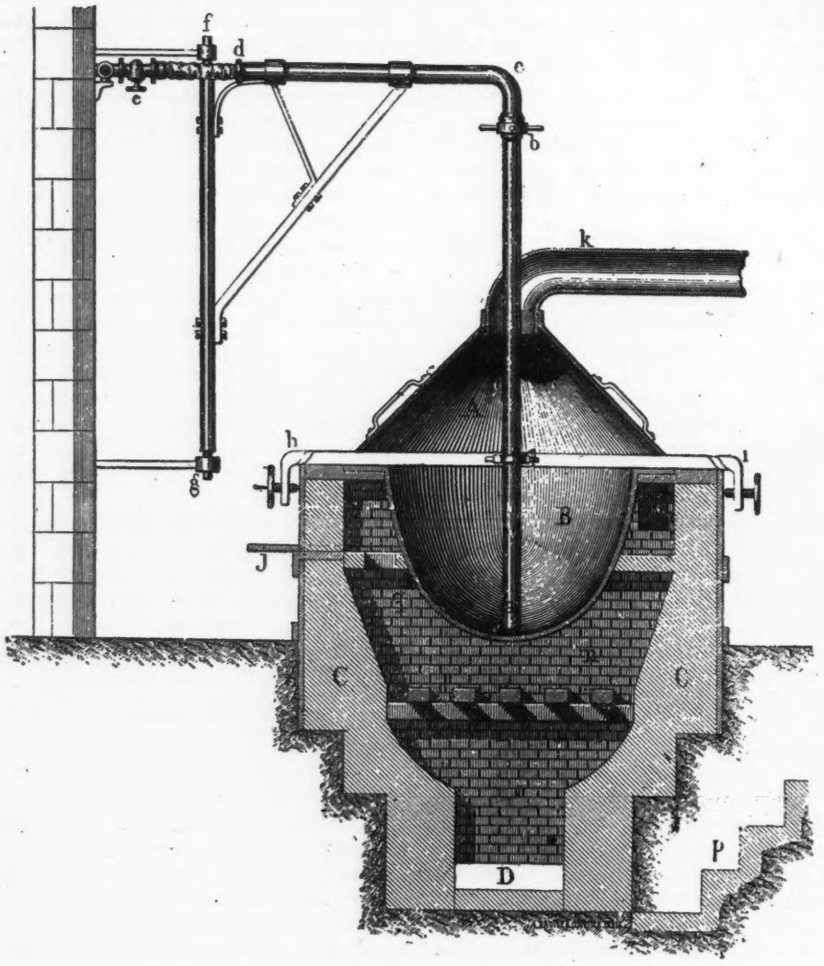
(7) Silica acts at high temperatures, 1000° and above, in decomposing lead sulphate and calcium sulphate, the latter being thus decomposed whether it be added as such or formed during the preliminary stages of the roast.

It is satisfactory to have a confirmation of our earlier ideas that lime does really play some part in the desulphurization of galena, which adds some interest to our original designation of this process as "lime-roasting." Yet we are unable to reconcile any great importance of lime in the process with some of the results that have been obtained with the Dwight-Lloyd method, which seems to be essentially one of promoting combustion by intensifying atmospheric oxidation, just as fine coal burns only with difficulty in a pile, more rapidly on a grate with an air blast through it, and almost instantaneously when blown with air into the combustion chamber of a furnace.

Apropos of the processes of Huntington-Heberlein, Savelsberg, etc., a distinguished metallurgist lately called our attention to a description of the Roswag system in "Encyclopédie Chimique," Sect. 1, Vol. V, p. 243, published in 1884, which seems to be distinctly anticipatory and worthy of reproduction out of historical interest. The following is not a literal translation, but rather is a condensed version, preserving all of the essential facts:

"Fig. 65 represents a vertical section of a roasting apparatus by means of compressed air, which consists essentially of an open ordinary pot of cast iron with a capacity of from five to six metric tons of crushed ore, at the bottom of which is placed a bath of molten lead (8 to 10 cm. thick); in this bath is plunged an iron pipe, *ab*. The valve *e* regulates the desired quantity of air.

"The pot is given a milk of lime wash at the commencement of each operation. Sulphide minerals or matte, finely broken, are charged upon the bath of lead to the quantity of five or six metric tons. The fire on the grate under the pot is then urged until the lead bath is dull red. Then the air is introduced, passing through the bath of lead and spreading itself through the charge, which becomes rapidly incandescent by the oxidation of the sulphur, and which moves in small eddies, regulated by the valve *e*. The pipe ought not to touch the bottom of the pot and should be withdrawn, from time to time, in order to cool it and to avoid its being corroded too rapidly.



Desulphurizing Apparatus, Roswag System
("Encyclopédie Chimique," 1884)

"In this system of roasting, many pots may be kept going at one time and the operation is finished in five or six hours; i.e., at the rate of a ton per hour. With a sufficient number of pots (a battery of Pattinson kettles is excellent for this purpose), and with a very small expense for combustible, because the combustion is self-sustaining, the process is very rapid and ecomonical. Not only air, but also superheated steam or even plain steam may also be used."

Apparatus Used in Spain

This process was actually in use as evidenced by the following excerpt from Sec. 2, Vol. V, of the "Encyclopédie Chimique": "Argentiferous lead-copper matte from the Herrerias works of the Marquis of Almanzora, near Villaricos, is ground to powder, and charged in an ordinary crystallization kettle, which contains a molten bath of lead about 100 cm. deep. About five metric tons of matte are then charged. When the matte is at a red heat, compressed air is introduced and in about six hours dead roasting is attained.

"The sulphurous acid disengaged, which should be useful for the manufacture of sulphuric acid, has been taken into one of the works' chimneys of high draft. It is useless to rabble or stir the charge, because all of the pulverized matte, upon the introduction of the air, oscillates and dances upon the bath of lead underneath it. The gas which escapes produces a gyratory and undulatory movement which stirs up the matte perfectly.

"It is well, however, from time to time that the workman and his assistant, who suffice for the working of six pots, i.e., 30 tons at a time, should permit the iron pipe which goes to the bottom of the pot to cool off, and that they should break off any nodules and knock off any crusts which have formed. As to rapidity, economy and ease of work, this system (which is not patented) is superior to all known methods of roasting."

The similarity of the later methods of pot-roasting to this early one is self-evident. The apparatus was indeed clumsy. We fancy that the air pipe going down through the charge was rapidly corroded and trouble on that account, together with the unhandy means for discharging the pot, was perhaps the reason why the process did not survive. The function of the lead bath is not quite clear. Likely it was to hold up any molten matte running down to the bottom, such matte under the conditions existing being blown as in a bessemer converter. The grate beneath the pot was, of course, to melt the lead and start the process. Anyway this is a good example of an early metallurgical novelty on a line that developed into importance about 15 years later.

The Situation in Mexico

Gen. Porfirio Diaz, former president of Mexico, is reported from Spain as having said recently: "The world can see now that I was no tyrant, but a severe governor who realized that an iron hand would alone keep Mexico prosperous and peaceful." As revealing the real situation in Mexico the communication of a special correspondent of the *Evening Post*, writing from the capital, published in its issue of Apr. 2, seems to us so accurate, from our knowledge of the country and its people, as to be worth repeating nearly in full, as follows:

The political situation in Mexico is sufficiently distressing. Everybody feels sorry for Mexico, for the Government, and for the revolutionary party which is fighting to destroy it. Both parties are misguided, the one in the lack of knowledge of the characteristics and limitations of the people which it would govern, and the other in its total ignorance of the meaning of liberty, namely, that liberty is not license, but stands preeminently for law and order.

Army Inadequate

From one end of the country to the other disorder prevails; burning, stealing, murder, and rapine are of every-day occurrence. The Mexican army as now constituted is totally inadequate to suppress the spreading flame. A handful of so-called disciplined troops is massed in the various larger cities, but the country at large is at the mercy of marauders. The total fighting force of the government, including rurales, cannot be over 16,000 men, in a country with 14,000,000 inhabitants, of whom 10,000,000 are of the lowest class and wholly uneducated.

Gen. Porfirio Diaz was a god to these people; his very name carried fear, his personality was overwhelming, and they were cowed into submission. The Madero revolution was instituted, based upon many undoubtedly needed and sound reforms. That was a real revolution from the beginning; its successful issue is a matter of history, and in due time Francisco I. Madero was almost unanimously elected president in perhaps the first legal election ever held in Mexico.

But the average Mexican has a fear of power, with no respect for office; that is, he has no conception of the fundamental sacredness of constituted government *per se;* hence as soon as the new government was installed, the bandits and thieves, undoubtedly fully believing that now they could practice their own free will under their own government, began their depredations, which have continued unceasingly. For a long time there was no thought of revolution; it was just a campaign of unlawful pillage, which spread from state to state.

The Zapata Outbreak

With one exception, there was no scene of military activity. That exception was the state of Morelos, south of Mexico, of which Cuernavaca is the principal city. Here a former Maderist chief, Emiliano Zapata, defied the national order to lay down his arms and disperse his troops, and continued in the field, keeping his force together and gathering arms and supplies by plundering the rich haciendas with which the state abounds, even threatening the city of Cuernavaca. At one time he came to the City of Mexico to confer with President Madero, at the latter's request, and, it is said, with every evidence of truth, that the president gave him 15,000 pesos in cash, on the understanding that he would return to his men and deliver up their arms. Zapata did return, but only to use the money for arms and ammunition and pay for his men. The depredations continued. For months that band was the only organized force against the government, and, while troops, considered to be of the best character, were sent against it repeatedly, only a few skirmishes were fought, with no visible effect, and the band continued its operations, without the least attention to the president's repeated and kindly offers of amnesty.

Government's Vacillation

Disorder which is not suppressed grows; it never stands still. The government, with all the forces at its command, was unable to suppress or did not suppress Zapata. The inevitable consequence was that its inactivity emboldened others; the disease spread; the natural cupidity of the unemployed took live form; they saw the opportunity to take from others what they could use for themselves, for one of the conceptions which they do not possess is that of the right of possession except by superior force.

Throughout all these disorders the government did pursue a "weak and vacillating policy," as was stated by a leading American resident at the recent meeting of Americans to discuss self-defence in this city. Instead of putting down disorder with cold steel, all sorts of compromises and amnesty were offered again and again without the slightest effect, only seeming to strengthen the assurance of the marauders.

President Madero is a man of education and high ideals; he is of a gentle and kindly disposition; affectionate in the extreme in his family, where the writer has often seen him; undoubtedly truly patriotic; but though he is a Mexican, he does not know Mexicans; he is a philanthropist in the midst of an unappreciative people. There is little doubt that if they would let him alone and permit him to proceed with the reforms

which he has promised them and wishes to carry out, he would make a great and modern President. It is his misfortune that he represents civilization in the midst of savagery.

In the beginning there was no insurrection, it was simple brigandage. When it began to be seen that the government seemed to be unable to cope with the growing troubles, buried ambitions arose, and insinuations began to be spread as to the unfitness of President Madero for the office. General Reyes, once the idol of the people, appeared on the scene, but he smacked too much of the old régime, and soon passed away. Then Vasquez Gomez, a deposed member of the Madero cabinet, came out in opposition, spread his propaganda, and disorder developed into revolution.

Desertion of Orozco

Pascual Orozco, a strong Madero chief in the last revolution, and one of the most trusted federal generals, finally deserted the constitutional standard, and has swept the entire north down to Torreon, which he can hardly fail to capture within a very short time.

That the victorious rebel army will march on to the south, and increase in numbers as it comes, cannot be seriously questioned. Meanwhile, General Zapata is threatening Puebla, the second city of the republic; he is already in its environs, and has formally demanded its surrender. The authorities state that they have dispatched 1000 more troops to defend it.

The capital itself does not contain much of a garrison. The facts are that there are fewer than 2000 regular soldiers here, with a well-equipped police force under an unusually efficient governor, Don Ignacio Rivero, one of the strongest and most active men in the government. The foreign colonies are all armed and organized for trouble, if it comes; machine guns, rifles, and pistols are near at hand, and there are companies with officers. It is not probable that any serious trouble will break out in this city. The facts of these preparations are well known locally, and it is only locally that danger will arise, from mob violence and its accompaniments. The city will never be bombarded nor taken by storm, for, while President Madero, with his optimism and idealism, will hold his office to the last resort, nevertheless, should he see from his palace balconies the dust of the rebels under Orozco and Zapata hovering over Mexico, he must perforce recognize the inevitable and give up the city to the new power.

Government Expected to Fall

With these things in mind—actual conditions and Mexican characteristics—it appears to any thinking mind which delves beneath the surface that the Madero government must fall. If Mexico had an army it would be different, but it has not. There is no doubt that the fighting value of a federal against a revolutionist has been largely overestimated. Had the government defeated and captured Zapata in the first place, it would probably have been in complete and peaceable control of the republic to-day.

Daly-Judge Mining Company

The report of the Daly-Judge Mining Co. for the year ended Dec. 31, 1911, shows that the net gain for the year was $115,404, after the payment of a dividend of $45,000. The surplus earned interest to the amount of $18,838 which is considerably in excess of the annual drainage expense.

The total amount of prospecting and exploratory work during the year was 7498 ft. The fissure vein, which trends to the southwest through the Ontario, Daly and Daly West mines, has been proved in the Daly-Judge for a distance of over 2600 ft. and with a comparatively small amount of stoping done to date. General Manager Lambourne believes that this vein extends throughout the Daly-Judge property for its entire length, a distance of about 11,000 ft., and into the ground of the Snake Creek Mining & Tunnel Co. beyond. This is the most important of the several ore-producing veins so far demonstrated.

The production of the mine for the year was 51,875 tons of milling ore and 7,586 tons of shipping ore. The cost of mining this ore was at the rate of $3.09 per ton to which must be added $2.38 per ton for prospecting and dead work.

From the 51,875 tons of ore treated in the mill, 12,237 tons of lead concentrate and 3919 tons of zinc middlings were made. There were concentrated 4.2 tons of crude ore into one ton of lead concentrate and all products combined 3.2 tons. The milling costs are given as follows: Concentration, 51,875 tons at 79c.; general expense, 59,461 tons at 25c.; marketing cost, 22,606 tons at $1.03. This makes the total cost of mining and milling, on the basis of 59,461 tons, $6.81 per ton.

Two Janney-Richards classifiers were installed during the year, one to treat the table feed and one to treat the zinc middlings. This equipment is reported by Superintendent Mason to be making a well classified feed for the table resulting in a closer saving. A higher-grade zinc product is being made from the zinc tables; where a 30% product was formerly made it is now possible to make a 40 to 45% product. During November and December two shifts were employed at the mill, one shift during January and again two shifts beginning Feb. 7, 1912.

The report states that the present drainage facilities are equal to expectations and levels can be driven in any and all directions and to any depth desired without the danger of developing dangerous and excessive flow of water. The extension of the Ontario drainage tunnel is so far advanced that crosscutting can begin from the shaft on the 2500 level at any time desired, once that depth is gained, or from the tunnel itself.

An ore contract was negotiated last year with the International Smelting & Refining company which gives the Daly-Judge company better smelting terms than it has ever had. This contract is on a tonnage basis and will run for several years, even if the annual production exceeds that of last year materially. Owing to unfavorable circumstances existing in the zinc-smelting industry it was impossible to dispose of the zinc middlings to advantage and since last October these have been stored near the mill for future disposal. On Jan. 1, about 1136 tons of these middlings were thus stored, valued at approximately $18,000, which under more favorable conditions would have been marketed last year increasing the income to that extent.

To eliminate any possible future litigation with owners of the property along the creek carrying the tailings from the Daly-Judge, Daly West and Silver King Coalition mills, an arrangement was perfected between these three organizations by which over 700 acres of land were purchased for impounding purposes. The water is to be reconveyed to the creek after settling, thereby avoiding any possibility of trouble with the farmers, and providing for the accumulation of tailings which may at some future date be an asset.

Prussian 1910 Mineral Production

The report of the kingdom of Prussia recently issued, for the year 1910, shows the following official statistics of mineral production:

Bituminous coal, 143,771,612 metric tons, $337,424,704; lignite, 56,644,291 metric tons, $32,188,928; salt, 6,205,242 tons, $15,386,608; zinc ore, 714,855 tons; iron ore, 4,823,606; copper ore, 903,834; lead ore 133,955 metric tons, $3,292,812; other miscellaneous ores, $2,849,336. Zinc and lead ores fell off in tonnage; lignite, lead ore and miscellaneous ores in value.

There are stated to be 575,747 workers in the bituminous-coal industry; 56,186 workers in lignite; 23,056 in iron ore; 16,912 in salt; 16,059 in copper ore; 15,130 in zinc ore; 8744 in lead ore; and 3262 miscellaneous.

Colburn-Ajax Mill, Victor, Colorado

By S. A. Worcester*

A description of the mechanical features of this new Cripple Creek mill which is using the Moore-Clancy process. The dust produced in crushing is withdrawn to a special collecting house and returned to process. Many mechanical devices used to make the operations about the mill as automatic as possible.

*Mechanical engineer, Victor, Colo.

The Colburn-Ajax mill, which was built according to my design and under my superintendence, was partially described in a previous issue of the JOURNAL,[1] and I am adding herewith a brief description of some of the features not formerly mentioned, which I think may be of interest.

SYMONS GYRATORY CRUSHER USED

The No. 5 Symons gyratory crusher used at the sampler was adopted in preference to the jaw type for the reason, primarily, that it can be operated almost without attention. In this case a specially designed cylindrical hopper of heavy-steel plate, 8 ft. in diameter and 3 ft. high above the slope, is added to the smaller cast-iron hopper furnished with the machine. Into this hopper the motor car dumps its entire load of perhaps five tons of coarse rock from the mine or dump and goes away for another load, leaving the crusher to empty itself, which it does without further attention other than occasionally to pick out the sticks and chips which come from the mine in considerable quantities. The motor-car operator attends to this.

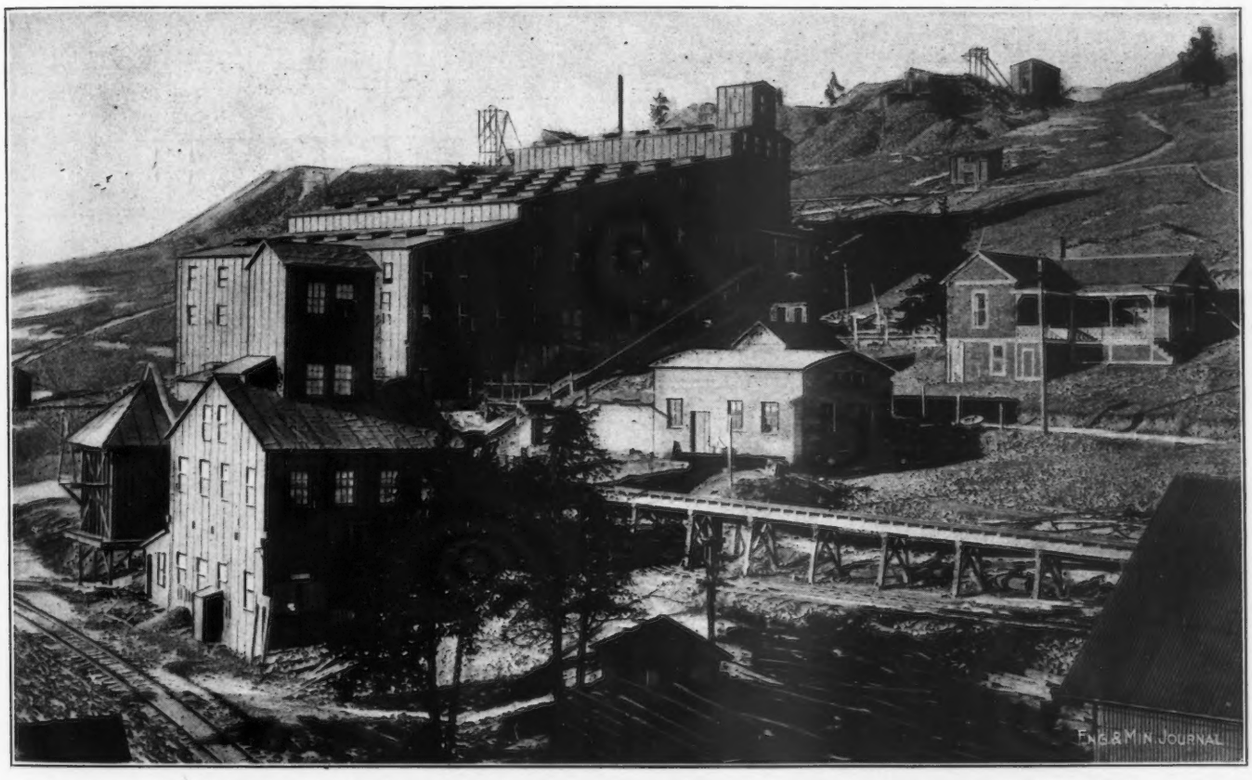
Among the desirable features of this crusher are: The small head room or mill height required, only about half that of the older types of gyratory machine; the complete and efficient oiling system, including an oil reservoir of several gallons capacity, and a small pump which constantly maintains a copious flow of oil through all important bearings; an oil-cooling device which keeps the oil from heating; and the much greater ease of repair with this short machine, as compared with the older type.

DUST COLLECTED IN SPECIAL HOUSE

One feature of this sampling plant is the arrangement of exhauster and dust house for removing dust from the various places where it is generated and preventing it from appearing in the main building; also saving the precious metals which this material contains. A 15-in. Sturtevant exhauster is piped with branches to every machine making much dust. It discharges into the peak of the roof of the dust house, which is 16 ft. square in plan with sides 16 ft. high. The sides of this house consist of a skeleton of 2x8 studding, covered with burlap. The roof has an overhang of 4 ft. This house is situated about 12 ft. from the sampler building.

The floor is covered with No. 28 steel, and a spout near the door descends from the floor to the main conveyor from sampler to mill. The burlap is held by washered tacks to ¾x1½-in. slats, placed horizontally 12 in. apart. The slats are held loosely by wood screws, allowing ½-in. play endwise on the screw. Most of the dust blown into this house drops to the floor, but large quantities accumulate on the burlap. Whenever the burlap shows by bulging that it is commencing to choke up, the slats are rapped with a pole, which cleans the burlap quickly and effectively. The sampler building is noticeably free from dust and much labor in sweeping and cleaning is saved. When the dust becomes thick on the dust-house floor, it is scraped into the spout and delivered by the conveyor to the mill.

The three sets of Allis-Chalmers rolls are kept true by using a portable electric



THE COLBURN-AJAX MILL AT VICTOR, COLO. THE DUST HOUSE AND SAMPLER ARE SHOWN IN LEFT FOREGROUND

[1]Eng. and Min. Journ., Dec. 2, 1911.

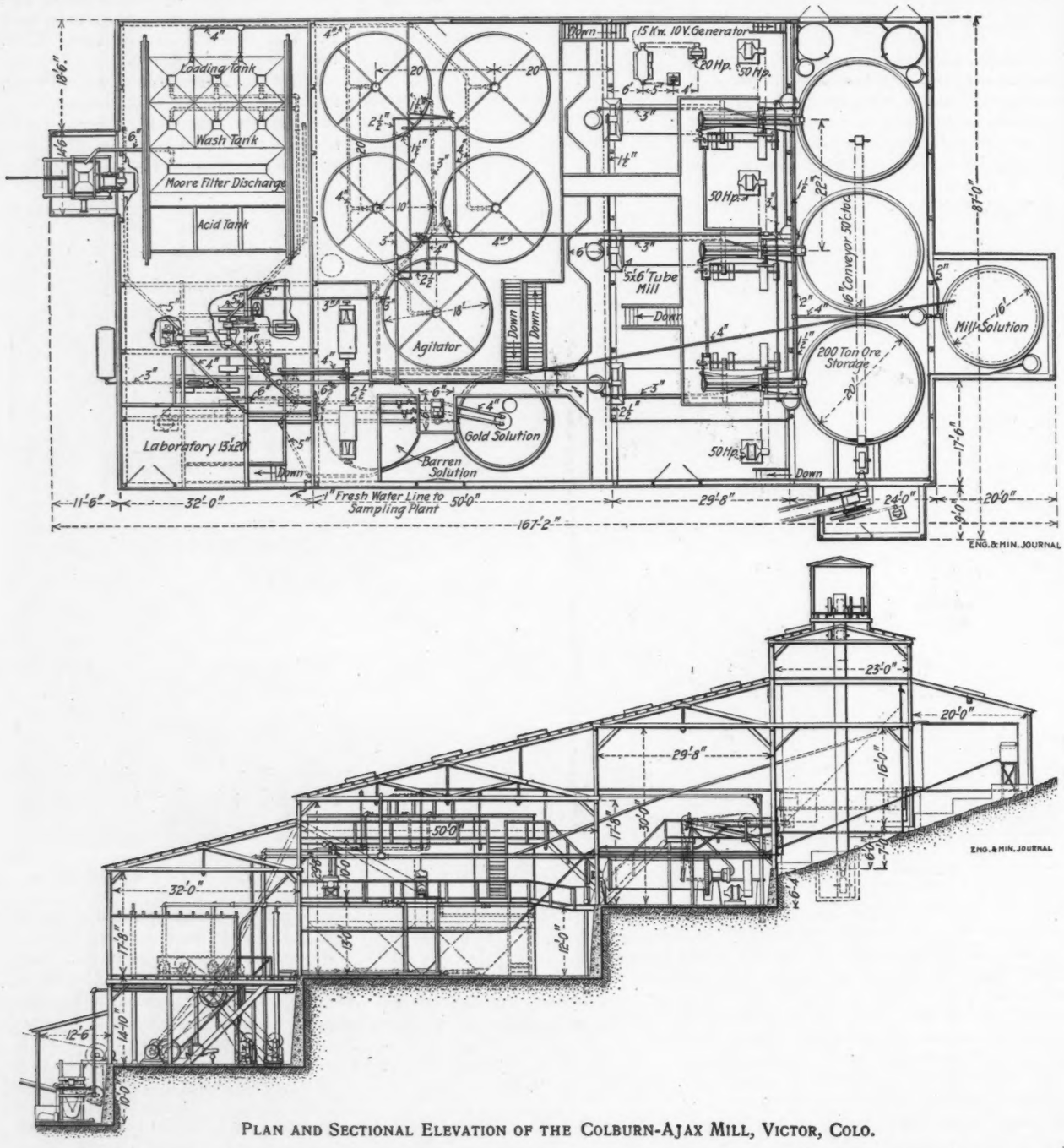
grinder. It is mounted on a substantial cast-iron slide rest, which is bolted to the lower portion of the roll housing, the end section of the upper portion being removed for this purpose. The upper part of the housing is made in three parts, so as to allow this grinding without removing the spouts.

The man elevator, which is now regarded as almost a necessity to every sampling plant, is situated near the center of the building, and extends from the ground floor to the extreme top elevator floor. This "man lift" is merely a 10-in. belt running vertically from one 10-in. pulley to another one and having hand or foot holds, spaced 6 ft. 4 in. between centers. These grips are fastened to the belt with elevator bolts. The openings at the floors, through which the man and belt ascend and descend, are 26 in. square.

The sample, which, in dealing with lessees, is retained until the lot of ore is settled for, is caught below the Snyder sampler in a box 18x18x18 in. outside, made of ¾-in. lumber and lined with No. 28 steel. A number of these boxes are provided and, as they weigh over 200 lb. each when full, a truck is used for moving them around the steel-plate floors of the sampling rooms, and a small friction hoist is used for lifting them to the split sampler. The boxes have trunnions, which are engaged by the short arms of the truck, or by the hoist bail.

Small Hoist for Samples

The 10-ft. operating lever of the sample hoist has a cord attached to its single end and passed over a pulley, then down within reach of the operator. The weight of this lever holds the 20-in. friction wheel normally against the wooden brake shoe. Lifting the lever a little by means of the cord allows the drum to run free, and lifting further makes the 20-in. iron pulley engage the 8-in. wood pulley on



Plan and Sectional Elevation of the Colburn-Ajax Mill, Victor, Colo.

the running lineshaft, thus hoisting the load. This hoist is just outside of the sampling room, and the ¼-in. wire rope passes over two sheaves and down through a slot in the ceiling. It hoists the sample at a speed of 30 ft. per min. and is easily managed.

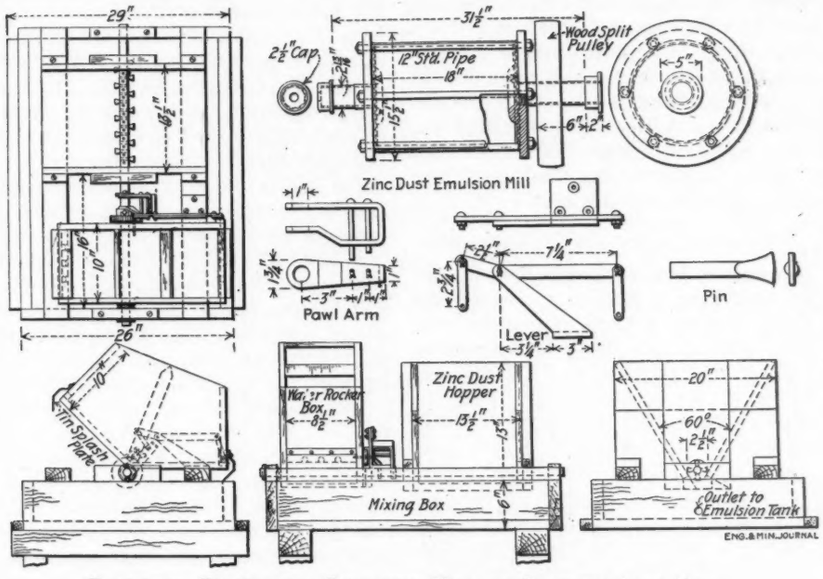
For grinding the final sample pulp, a McCool sample grinder, a recent invention, is used. This machine uses 9½-in. disks for grinding surfaces, one of the disks having an eccentric movement in the vertical plane, in addition to its rotary motion. Among the desirable features of this machine are its ease of cleaning, substantial construction and complete self-lubricating arrangements. Another desirable point is the easy adjustment for fineness of product, made by a hand nut without need of any locking device, while grinding. The machine grinds with remarkable rapidity, an ordinary pulp being put through in a few seconds.

The ore, reduced by the sampler to approximately 10-mesh maximum size, is delivered by conveyor and belt elevator to a 50-ft. horizontal conveyor, which discharges by means of stationary trippers or end discharge, to any one of three cylindrical steel-storage bins. These bins, with flat bottoms, have a total storage of 400 tons each, with automatic discharge for 200 tons each. This gives storage capacity for several days' supply of ore and prevents the stopping of the mill in the event of a shutdown at the sampler. Each bin has a 12-in. belt feeder, surmounted by a semi-circular steel hopper 6 ft. in diameter, having a sliding discharge gate with screw adjustment.

Tube Mills for All-sliming

The belt feeds the ore direct into the classifier, a specially designed machine of the screw-conveyor type of large capacity and inexpensive construction. The screw is an inclined ribbon conveyor with its lower end and bearing completely submerged. Slime is prevented from entering this bearing by maintaining a continuous small flow of solution through it. Coarse material from the classifiers goes to 5x16-ft. tube mills, driven by 50-hp. motors. Features of these tube mills are the center-feed spirals, eliminating the feed box; the improved El Oro lining, using no bolts, or holes in the shell; collar oiling bearings; steel pinions; ample drive pulleys, 74x15 instead of 60x10 in. in size, as is common practice.

The tube mills discharge into small tanks having floats which regulate automatically the air lifts for returning the mill product to the classifiers. In addition to saving attendance, these floats economize air, using just what is necessary to prevent accumulation of pulp at this point. The slimes from the three classifiers join in a central float tank, from which they are raised by an automatic air lift to the agitators. These cone-bottomed steel tanks have central column pipes rising to half the height of the cylindrical portion of the tanks, with air jets at their bases. The agitators are so connected that continuous agitation in series may be practiced at any time, if desired. The general arrangement of piping, valves, etc., throughout the mill is also complete, so that almost any desired system of operation is possible.



ZINC-DUST FEEDER AND EMULSION MILL AT COLBURN-AJAX MILL

Graphite Anodes and Iron Cathodes Used

The anodes for the Moore-Clancy electrolytic apparatus are of Acheson graphite, about 40 in. long and 4 in. in diameter. The cathodes are iron plates about ⅛ in. thick, 6 in. wide and 40 in. long, four to each anode. These plates, curved to a 10-in. circle, are soldered to spiders 10 in. in diameter, concentric with the anodes, making "baskets," which are submerged about 6 ft. in the pulp. The low-voltage switchboard controlling the current to the electrodes is situated on the upper floor, centrally between the four equidistant agitators. At the conclusion of the treatment the slimes pass to the Moore filter plant.

The pregnant solutions drawn by the vacuum pumps through the filter leaves are discharged into the gold tank, but if during the washing the solution becomes nearly or quite barren, it is directed to the barren-solution tank by merely closing the valve in the pump discharge leading to the gold tank, forcing the solution to rise out of the tee over the barren tank.

The suction inlet of the filter-press pump is a perforated ring of 4-in. pipe, suspended about 12 in. below the rim of the gold tank. The solution enters the tank in the center-column pipe, the lower end of which is raised above the bottom of the tank, leaving an annular opening, 12 in. high, through which the solution passes out into the tank. This arrangement of inlet and outlet makes the tank an effective clarifier, without the use of filter leaves or equivalent devices. The filter-press pump is regulated by a float in the gold solution, which opens or closes a by-pass between the suction and discharge pipes, so as to maintain a nearly constant level of solution in the gold tank and to prevent the suction inlets from being uncovered.

Special Zinc-dust Feeder and Emulsifier

The pump for returning barren solution to the mill-solution tank is similarly governed by a float in the barren-solution tank. The zinc-dust feeder and emulsifier, illustrated in detail, consists of a hopper, from which the dust is fed by a flight screw conveyor into the mixing box. From the mixing box the solution which operates the rocker box washes the dust through a small pipe into the tube mill below, where it is thoroughly emulsified. The flights or pins used instead of the ordinary continuous screw seem to prevent the dust from packing in the hopper, a common trouble with this type of feeder. The rocker box, a familiar device to mill men, operated by the alternate filling and emptying of its two compartments, turns the feeder screw at each movement of the box by means of the two pawls and lever arrangement shown.

The tube mill rotates about 20 turns per min. and discharges its product into a funnel having a screen which prevents foreign materials, pebbles, etc., from entering the siphon through which the emulsion passes to the suction of the filter-press pump. The emulsion enters this suction at the tee at the edge of the gold tank. The emulsion mill is fed with

the same pebbles as the larger mills, introduced through the discharge trunnion.

Fresh water comes to the mill from a large storage tank situated on the hill, so as to give a pressure of about 25 lb. at the float tank, near the mill-solution tank. This float reduces the pressure of fresh water to about 12 lb., a safe limit for discharging cakes from the Moore filter leaves. Another float maintains a constant solution pressure at the classifiers, which have separate solution cocks for regulation and for shutoff, so that in case of short shutdowns the regulating cocks are not disturbed. Floats also regulate the height of solution in the lime and cyanamide tanks and prevent overflows.

Hydraulic Crane for Operating Filter

The hydraulic crane for hoisting and traversing the Moore filter baskets is supplied with water by an air-cushion accumulator or receiver, at a maximum pressure of 275 lb. This pressure is generated by a 5x8 Deane triplex pump, governed by a Mason regulator, which operates a bypass from discharge to suction.

As the room for tailings below the mill is limited and water is expensive, it is aimed to keep the moisture at the lowest practical limit, so that the tails will pile as high as possible. The standing cable on which the tailings bucket travels rises at an angle of 15° from the horizontal, and is carried over a 105-ft. tower. It is the intention to almost bury this tower, of cheap wooden construction, before finding dumping ground farther away. It is probable that old mine stopes will be used for this purpose later. When, for any reason, the moisture becomes excessive, the tails are simply run out through a pipe and dammed up.

Nearly all of the electric equipment of this plant was furnished by the General Electric Co. The current is furnished by the Arkansas Valley Railway, Light & Power Co. from its steam generating plant at Cañon City, about 40 miles distant, at a pressure of 22,000 volts. The transformer house, which is the only all-concrete structure in this district, is a roomy building, and is equipped with aluminum-cell lightning arresters, oil switches and a complete set of recording meters. The tube-mill motors are of the hoist type, with reversing starters and large resistances, and have large overload capacity. Friction clutches are dispensed with by using these motors with large pulleys.

Among the general characteristics of the plant may be mentioned concrete foundations on solid ground for all heavy machines; all ground floors and building foundations of concrete; ample belt and pulley dimensions for all important motor and machine drives and their careful arrangement; a large number of fire hydrants conveniently situated, with hose connected and nozzles ready for use; the system supplied with water from a fire pump, which is in constant operation, so that pressure is always instantly available by simply opening one valve and closing another; a large number of chemical fire extinguishers, situated in prominent places, and a complete inter-communicating telephone system. All important wiring is carried between buildings in conduits.

Petroleum Deposits in Chile

By Cesar Zelaya*

Deposits of petroleum are known to exist in southern Chile in a zone extending from Chiloe to the Maullin River. The first discovery was made near the town of Carelmapu. Up to the present time few people have paid as much attention to these deposits as they truly merit. This is because of their remote situation, and also because their exploitation is a new thing in Chilean industry. Prof. Miguel R. Machado has published in various papers the results of his observations in the field, and has called the attention of the government and Chilean industry in general to the possibilities that there await development.

Petroleum Discovered 20 Years Ago

About 20 years ago the French government sent geologists to Tierra del Fuego to make a study of the zone and to gather data pertaining to the natural history of Patagonia and Tierra del Fuego. These geologists, upon their return to France, said that they had found deposits of petroleum in this zone, and also on a large island off the coast.

A few years later other discoveries of petroleum were made by Chileans who visited the region because rich, gold placers had been found there. These discoveries resulted in nothing because of lack of capital.

The rocks found in this zone are of sedimentary origin and correspond, in greater part, to those known as "green sandstones," composed of grains of quartz, magnetite, titanite, mica, etc., cemented by clay in some beds and by lime in others.

Gold Found in the Petroleum Field

In general these petroleum fields are covered by rock detritus that has been formed into heaps by the wind. This detrital material is of granitoid rock: granites and syenites. In other places exist thin beds of volcanic ash inclosed on all sides by gravel and sand in which gold occurs, the presence of which gave rise to the exploration done in this field many years ago.

In the geological studies on this region, made by Darwin, d'Orling, Nordenskjold, Fuchs, and the Argentine geologist, Dr. Florencio Arrieglino, it is stated that the rocks belong to the upper Tertiary, the formation in which exist many of the petroleum deposits of North America, Russia, Roumania, Turkey, Germany, Perú, China and Borneo.

A few years ago an American went to that region to explore the gold-bearing sands and gravels. In sinking a shaft he was surprised to find an emanation of gas having the characteristic odor of petroleum. A small company was formed to investigate the origin of the gases, but the enterprise came to grief through lack of capital and poor management.

Analysis of Gaseous Emanations

The gaseous emanations from shallow wells burn with a bright yellow flame, and bubbles of gas bursting in water produce on its surface the characteristic iridescence of petroleum. A sample of the gas was sent to Paris for analysis with the following results: Oxygen 3.21%, nitrogen 12.07%, equal to 15.28% contained air; oxygen 1.44%, hydrogen 0.18%, equal to 1.62% water vapor; and carbon 68.77% and hydrogen 14.33%, equal to 83.10% hydrocarbons.

The results of these analyses being satisfactory a company began to sink a series of wells, one of which was sunk to a depth of 1100 ft. This well passed, at a depth of 150 ft., through a bed of lead-bearing clay, containing grains of quartz. At 450 ft. gas was tapped and in greater quantity at 650 ft., while at a depth of 750 ft. the hole passed through a layer of cemented rock containing much calcite. From this bed which was 80 ft. thick, much gas was given off. At 1000 ft. a thick bed of sand was passed through and at 1100 ft. the well passed through a bed of fine sand composed largely of quartz, calcite, and grains of some green mineral. Unfortunately the work could not be continued on account of lack of capital.

Influence of Atmospheric Pressure on Flow of Gas

The quality of the gas found during the exploratory operations was excellent. A 3-in. tube sunk to a depth of 25 ft. produced sufficient gas for illuminating, cooking and heating at the company's plant. It was observed that when the barometer was low and the sandy ground was soaked with rain water, the capped tube gave forth from four to five times as much gas as when the barometer was high. Small quantities of liquid hydrocarbons were also noted.

The work that has been done indicates that there is a vast field for exploratory work for petroleum in this region in southern Chile, in which forests, lignites, gold-placer deposits, and sheltered seaports, will, it is hoped, prove advantages that will help to obtain the capital needed for further work.

*245 West Twenty-second St., New York.

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MINERALOGY By F. H. Hatch. Third edition, rewritten and enlarged. 5x7½ in., pp. 261, illus.; $1.40. Whittaker & Co., London; Macmillan Co., New York.

The new edition of this well known work consists of two parts, the first of which is devoted to the properties of minerals in general; the second is a catalog of the properties of the more common rock-forming and ore-making minerals. The author has given much attention to his classification of minerals, but the book does not contain tables for quickly establishing the identity of a specimen by field tests and does not emphasize those characteristics by which a mineral can be readily distinguished from others which it closely resembles.

THE TECHNICAL ANALYSIS OF BRASS AND THE NONFERROUS ALLOYS. By William Benham Price and Richard K. Meade. 5½x7, pp. 267; $2. John Wiley & Sons, New York.

This book gives the determination of aluminum, antimony, arsenic, bismuth, cadmium, cobalt, copper, iron, lead, magnesium, manganese, nickel, phosphorus, silica, sulphur, tin and zinc in their various alloys, beside special chapters on specific combinations, such as phosphor bronze, babbitt metal, etc. There is also a good chapter on alloys in general, and one on the general art and practice of electro-analysis. This is a useful reference book for the foundry or general commercial chemist.

METALLURGY, VOL. I. By Herbert Lang. Pp. 255, Illus., $3. McGraw-Hill Book Co., New York.

This is the first volume of a series on general metallurgy. It deals chiefly with ore crushing, ore sampling, roasting, and smelting smoke. Consequently it does not proceed very far into its subject, and we are able only to surmise what the full treatment is going to be. We gather from the author's preface and from the character of this introductory volume that he has projected an analytical and comparative metallurgy in contradistinction to the ordinary descriptive treatise. Such a book is really needed, but the rank and value of any offering of this kind will depend, of course, upon its workmanship. Mr. Lang's cannot be properly judged from his partial presentation. The initial volume undoubtedly possesses both merit and defects. We feel that it suffers from its prolixity.

DIE SCHWERSPATHLAGERSTAETTEN DEUTSCHLANDS IN GEOLOGISCHEN, LAGERSTAETTENKUNDLICHER UND BERGWERTHSCHAFTLICHER BEZIEHUNG (The Barite Deposits of Germany, from the standpoint of the geologist, the student of ore deposits, and the miner). By Richard Bärtling. Pp. 188 + VIII, illus. 6.40 marks. Ferdinand Enke, Stuttgart.

Doctor Bärtling has prepared an interesting and valuable work upon one of the minor but still important industries of Germany. Germany is the leading source of heavy spar, as the following statistics of the world's production in metric tons for 1907, taken from p. 176 of the book, will show: Germany, 215,000; United States, 59,492; England, 42,646; Italy, 15,432; France, 11,150; Canada, 1829; Sweden, 559; Spain, 314.

Barite is employed in largest amount as a pigment either in the purified and finely ground condition, or else in combination with zinc sulphide in lithopone. It is also extensively employed in the chemical industries.

Barite is widely distributed in Germany, but the most productive regions are in the central-eastern portion of the Empire. It is a common veinstone, whether mixed with metallic ores, with earthy minerals such as calcite, fluorite, and quartz, or in veins by itself. We are chiefly familiar with it in veins in this country, usually in limestones. It also forms in Germany an extraordinary bed, and is not unknown in gravels or placers. The bed of barite which is the chief single source of the mineral in Germany, is found at a little town called Meggen in the valley of the Lenne River in Westphalia. It is the most peculiar and interesting of all the deposits. Resting on middle Devonian shales below, is found an extended bed of pyrite, which appears to have been deposited on the shales in regular sedimentary succession. It is covered above by a bed of limestone also of the Middle Devonian and is followed by Upper Devonian and Carboniferous strata. The pyrite is extensively replaced in its upper side and at times for its full cross-section with black, bituminous barite. Doctor Bärtling concludes that descending solutions of some oxidized barium salt have changed the pyrite to barite with removal of iron, but without essentially affecting the amount of the sulphur contents. After the replacement, the sedimentary series was folded in the Upper Carboniferous times, so that we conclude that the barite was deposited in the later Devonian and the earlier Carboniferous. The deposit now appears in a pair of synclinal folds with an intervening anticline and with both strike and dip faults.

With regard to the barite in many of the German veins, Doctor Bärtling brings out a very interesting relationship, first emphasized by Professor Krusch. Whatever the wall rocks were, though they be as old as the ancient gneisses, the veins appear where the *Buntsandstein* (or colored sandstone) of the Triassic either now covers the wall rocks, or did in the past. This sandstone yields waters with appreciable barium percentages and is regarded as the source of the mineral. Doubtless decomposing feldspars in the sandstone are its primary source.

Doctor Bärtling reviews the methods of milling, purifying and manufacturing of barite and closes his work with the statistics of production. The book should prove of much interest to those engaged in the barite industry, wherever situated.

J. F. KEMP.

PERSONAL

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

R. S. Botsford, of London, left that city, Mar. 25, for Vladivostok, Siberia.

C. Colcock Jones has returned to Los Angeles from Douglas County, Nevada.

Algernon Del Mar has been appointed engineer of the Wilshire Bishop Creek Co., of California.

H. F. Lefevre left New York, Apr. 8, for Guatemala, where he expects to remain about a month.

Kirby Thomas, of New York, is in Florida, making an investigation into some phosphate deposits.

Robert E. Cranston left San Francisco, Apr. 5, for Bodie, Mono County, Calif., expecting to return in about two weeks.

Philip Argall & Sons, of Denver, Colo., have been appointed consulting engineers for the Ozark Smelting & Mining Company.

Dwight E. Woodbridge has been in Alabama on professional business, and was in New York last week, going thence to Washington.

H. A. Linke has been appointed manager of the Nevada Central Copper Co. at Cedar, Nev. He left Chicago for the mine last week.

Arthur Scott, a graduate of McGill University, succeeds C. H. McMillan as general manager of the Dominion Steel Co. at Sydney, Nova Scotia.

Herbert L. Tuttle, lately of Mexico, has been appointed superintendent of the Cherryvale works of the Edgar Zinc Co., succeeding the late John C. Dods.

E. M. White, formerly manager for the Warrior Copper Co., has been appointed manager for the Manitou Copper Co., operating in the Globe district, Arizona.

Mowry Bates has resigned as manager of the Hughes Porcupine Mines, Ltd. He intends taking a few months' rest and visiting Mexico during the summer.

J. Sam Coupal, manager of the Compañia Minera de Santa Lucia, Oaxaca, Mexico, has returned to the United States. His address is at 821 East Fourth St., Boston, for the present.

B. G. Lott is mine foreman, C. T. Harris is master mechanic, L. Stewart and J. I. Kane are on the engineering staff of the Tiro General mine at Charcas, San Luis Potosi, Mexico.

H. Z. Bixler, formerly chief engineer of the Republic Iron & Steel Co., and recently with the Youngstown Steel Co., has been named chief engineer of the Brier Hill Steel Co., Youngstown, Ohio.

George L. Hoxie and Meade Goodloe have formed a partnership as engineers, with offices at Los Angeles, Calif., and at New York. Mr. Goodloe was formerly manager of the Imperial Copper Co. in Arizona.

W. N. Brown and G. D. S. Clarkson, both formerly with the Geological Survey, have formed the firm of Brown & Clarkson, mining and topographical engineers, with office in Southern Building, Washington.

James Daley, smelter at the open-hearth furnaces of the Ohio works of the Carnegie Steel Co., has resigned to accept the position of superintendent of construction with the Brier Hill Steel Co., at Youngstown, Ohio.

A. W. Newbery has left Ocampo, Mexico, owing to the closing of the mines of the Sierra Mining Co. there, and is now assistant general superintendent for the Mammoth Mountain Mining Co. at Isabella, Kern County, California.

Frank H. Probert announces that the firm of Weed & Probert has been dissolved by mutual consent and that hereafter he will continue in practice as consulting engineer and mining geologist with headquarters in Central Building, Los Angeles, California.

William C. J. Rambo and L. G. E. Bignell have formed a partnership as the Rambo-Bignell Engineering Co., to engage in mining and metallurgical engineering, office in First National Bank Building, Denver, Colo. Mr. Rambo was until recently superintendent of the Grand River Coal & Coke Co. at Cainesville, Mo. Mr. Bignell was for seven years with the Denver Engineering Works Co. as district manager.

Paul Kreuzpointer, a metallurgist for 32 years in the employ of the Pennsylvania Railroad Co., at Altoona, Penn., retired Mar. 25, having attained the age of 70 years, and his name goes on the pension rolls of that corporation. The announcement of Mr. Kreuzpointer's retirement has attracted wide attention, for he is probably one of the best known metallurgists as well as one of the longest in service in Pennsylvania, and his work has had an international influence.

OBITUARY

Elisha Robinson died at Parker's Landing, Penn., April 3, aged 79 years. He was one of the pioneer oil operators in Pennsylvania and remained in the business up to the time of his death.

Elias Cohn died at Aspen, Colo., April 2, aged 55 years. He was born at Fulton, Mo., and went to Colorado in 1889. He settled in Aspen and had been engaged in mining there ever since. For many years he represented the interests of D. N. Hyman, of New York. One of his achievements in mining was the unwatering of the Smuggler mine in 1910, by the installation of the Free-Silver shaft. Mr. Cohn was active in all questions affecting the civic progress of Aspen, and was president of the school board. He left a widow and two daughters.

Robert Maffett died at Bayonne, N. J., Apr. 8, aged 53 years. He was general superintendent of the works of the Orford Copper Co., at Bayonne. Mr. Maffett was born in Clarion, Penn. He married Mabel, daughter of John J. Thompson, who was a brother of Col. Robert M. Thompson, the founder of the Orford Copper Co. Practically the whole of his business life was spent with the Orford Copper Co. He entered the refinery as a foreman about 20 years ago and worked his way to the top. Besides his widow he leaves one son, John Thompson Maffett, a student at Yale.

Societies and Technical Schools

American Institute of Mining Engineers—The New York Section was to hold a meeting at the Engineering Societies Building, New York, April 12, at which Carleton Ellis was to address the section on the subject of "Flameless Combustion." In connection with this lecture, a demonstration of the process of flameless combustion was arranged in the city.

International Society of Mining Accountants—This society was organized in March. Its objects are to promote the science of accounting and allied subjects connected with the production of the useful minerals and metals on the American continents, by means of an annual meeting for social intercourse and the reading of practical papers on accounting, etc., and the publication of the proceedings in an annual volume. There will be two classes of members, active and honorary. Membership is open to any person interested in the objects of the society, provided he is actively engaged in mining or allied industries. The secretary is W. H. Charlton, 46 Hooker Ave., Detroit, Mich.

Munich Technical Museum—A small committee of directors of the German Museum in Munich, holding high offices, arrived at the end of March in the United States. The visitors are Count Podewils, late Prime Minister of Bavaria, Dr. von Borscht, mayor of Munich, and Dr. von Miller, Councillor of State. Munich possesses the finest collection of technical achievements in the world embodied in the German Museum. This museum is an exhibit of technical art and science, and as such is a recorder of the evolution of technical science in the world. The mission of the committee is one taken in the interest of technical brotherhood, especially with the purpose of bringing the German Museum into close touch with institutions in the United States devoted to the history of technical science. The committee, having only a limited time, would naturally like such Americans as sympathize with their mission to come forward with a view to facilitating an early communication.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 4—The present activity in California mining is indicated not only by the reopening and development of old mines, but also by numerous installations of new equipment in producing properties, and the construction and reconstruction of dredges. In Tuolumne County 20 new stamps have been added to the mill at the Dutch mine and 40 stamps will be dropping by Apr. 15. At the Black Oak mine the new tube mill and 75-ton cyanide plant should also be in operation by Apr. 15. The new 20-stamp mill at the Poundstone mine in Amador County is practically completed. In addition to the new electric hoist, compressor and pump plant at the Plymouth Consolidated two new plunger pumps have been ordered for immediate delivery. A new electric pump is being installed at the Champion mine in Nevada County. In nearly every district in the state there is activity in the way of added equipment and improving the facilities for extraction and treatment of ores.

In the dredging fields the Natomas Consolidated is rushing work on the reconstruction of No. 8 dredge, and on the new No. 10 dredge. The Union Dredging Co., of Philadelphia, has just started a 9-cu.ft. bucket dredge at Folsom and the Gaylord Mining Co. has installed a reconstructed 6-cu.ft. bucket dredge at Whiskey Bar in Placer County. The new suction dredge constructed for the Northern California Gold Mining Co., at Jelly Ferry on the Sacramento River, in Tehama County, is ready to dig. The Calaveras Dredging Co. has completed its 5-cu.ft. bucket dredge at Jenny Lind, in Calaveras County, and it is now operating. The Yuba Construction Co.'s shops at Marysville have orders for four dredges for Alaska and construction is under way. The heavy snow in March gave promise of sufficient water for the coming season, though there will not be an over-abundance now that there is no likelihood of further storms. There is prospect that there will be early developments in the new camps in Modoc and Plumas counties in the northeastern part of the state.

The president and members of the executive committee of the Farmers Protective Association visited the Mammoth smeltery at Kennett, on Mar. 26, to renew the complaint that the crops are being damaged by fumes. It is alleged on the contrary, by the officials of the Mammoth and some of the farmers not interested in smoke complaint, that the damage is the result of a long dry season and severe north winds, and that the blight extends beyond the possible reach of smoke from the smeltery.

Butte

Apr. 3—The output of copper of the Washoe and Great Falls smelteries, during March, was 25,900,000 lb. This includes ore from the Tuolumne and North Butte mines, and a small amount of custom ore, and shows a decrease of about 1,550,000 lb. from February. The East Butte company produced over 1,000,000 lb. in March, which made the production of the Butte district about 27,000,000 lb., for the month.

The Bradley process plant, which will operate on the slimes at Anaconda, has been started, but will not go into regular operation until all necessary adjustments have been made.

Orders have been received from B. B. Thayer, president of the Anaconda Copper Mining Co., to close the coal mines belonging to the company, situated at Belt, on June 30. At the time of Mr. Thayer's visit to Butte, in January, the officials of the mines were notified of the fact, and were told that the employees would be given notice sufficiently in advance for them to prepare for the suspension. The mines have been operated for 17 years, though not at full capacity all of the time. During March, 216 men were employed there.

Denver

Apr. 4—The Cripple Creek tonnage for March was 76,514 tons, of a gross value of $1,184,100. Of this amount, 4050 tons went to the smelteries, the value being $243,000. The annual booklet of the Colorado Springs Mining Exchange is authority for the statement that during the 20 years which have elapsed since production commenced in 1891, a total production of $296,680,734 has been made. The production for 1911 is given at $15,658,684, an average of $1,329,890 per month.

As the deep levels of the large mines have now been unwatered, it seems probable that the output this year will be increased over 1911. The real unwatering of the Cripple Creek mines began when the workings of the El Paso group were connected with the deep drainage tunnel by a drill hole. A similar project is now said to be underway in the Quartz Hill section of the Central City district, in Gilpin County, to connect the lower workings of the Kansas and Kansas-Burroughs groups of mines with the New house tunnel by drill holes. These groups, comprising the Phœnix-Burroughs, University-Kansas, Conley-Burroughs, Pease-Kansas, Kansas-Burroughs and Monroe mines, are said to have been taken over on lease and bond by Frederick Burger and John Sayre of Denver. All these mines are well equipped and work is to commence soon. The Newhouse tunnel cuts two of the veins of this group, 350 and 600 ft. below the bottoms of the shafts, and it is believed that most of the mines on Quartz Hill will be unwatered by this work.

In Leadville the shipments of zinc-sulphide ores are increasing, 150 tons per day going out from the Colonel Sellers, and a good tonnage also from the A. Y. & Minnie, Wolftone, Castle View, Robert Emmet and others. In March the output from the Wolftone was about 12,000 tons; Yak tunnel, about 10,000; Iron-Silver, 4000; Stars Consolidated, 4000; Ibex, 7000 and from South Evans about 6000 tons. The March output for this year was 70,000 tons compared with 50,000 tons in March, 1911. The Arkansas Valley plant has five furnaces in operation, which is greater than for many years.

Salt Lake City

Apr. 4—The date set for the completion of the remodeling of the Utah Copper Co.'s Arthur plant, is Aug. 1. Eight of the 13 sections are in operation, and the ninth is practically completed. The combined capacity of the Arthur and Magna mills will be 20,000 tons per day, and during the summer the management expects to increase production to that amount. Heavy snows have kept the ores moist, making them difficult to handle, so that at present it is not so much a question of mill capacity as of tonnage mined. The output for February was 8,612,729 lb., and with both mills running at full capacity the monthly rate will be about 13,000,000 lb. The Bingham & Garfield R.R. has operated satisfactorily throughout the winter and no delay in transportation has been experienced.

The second lead stack of the International smeltery, at Tooele, has been tried out and is ready for operation.

The Snake Creek drain and operating tunnel, in the Park City district, has been completed for 4065 ft., which is less than half the projected length. In August a cave-in stopped the work, and it was

found necessary to concrete the tunnel for 300 ft. This has proved successful, and the tunnel has progressed over 1000 ft. beyond the concreting. The face is in hard siliceous limestone, making good progress possible. Thirty men are employed, working two shifts. The flow of water, though still large, has diminished somewhat.

Wallace, Ida.

Mar. 27—The lower tunnel at the Stewart mine is now in working order and ore is being hauled through it. The wiring is completed and the generators are in operation. The ore is being dumped into the large bins, from which it will go by the new surface tramway to the railroad ore bins. It is estimated that the new tunnel will reduce the cost of production about $1 per ton, figuring on a production of 15,000 tons per month. As soon as milling facilities are arranged for, these figures are expected to be doubled. About 2500 tons of concentrates per month are now being shipped to the smelteries, besides a small tonnage of first-class ore picked from the sorting-plant belt. The February report of the company shows net earnings of nearly $45,000. The company has never paid a dividend, but has a cash reserve.

Deadwood, S. D.

Apr. 4—The Golden Reward company has adopted as a policy the leasing of a number of its smaller mines, and these are now in the hands of men who are preparing to operate energetically during the summer. Under the terms, the milling ore produced by these properties is treated at the Golden Reward cyanide plant, at Deadwood. Company operations will be confined to two or three of the larger properties, including the Astoria, where a roaster is to be built as soon as weather conditions permit.

Negaunee, Mich.

Apr. 6—The new 8-hour shift regulation is giving satisfaction to both miners and operators. At several mines a greater tonnage is being hoisted on an 8-hour shift than was formerly hoisted in 10 hours, and this is gratifying to the operators.

The day-shift miners are enabled to go to and from their work by daylight. Under the old 10-hour system, the men had to be at the shaft in underground clothes at 7:10 a.m., and they came up about 5:45 p.m.; due to delays in getting to and from the working place and to taking more than an hour at lunch, the net time of working was usually between 8 and 9 hours. The new rules make actual working time the significant factor, specifying full 8 hours.

The Employers' Liability and Workingmen's Compensation law has been passed by the Michigan legislature, and general satisfaction is felt over the result. It is hoped that in the future the majority of cash settlements for injuries to miners will not go to the lawyers, as has been the case in the past.

Toronto

Apr. 5—During the coming season the Ontario Bureau of Mines will send several parties into the northern part of the province. The first expeditions will be on geographical exploration work and will be specially commissioned to look into the adaptability of James Bay for shipping purposes. Other parties, however, will examine the Pre-Cambrian formations to determine what they offer in the way of minerals. The geological conditions in that part of the country are favorable for the discovery of deposits similar to those of Cobalt and Porcupine. Large deposits of iron ore are known to exist, and coal has already been discovered. Large portions of northern Ontario are practically unexplored and no part of it has as yet been prospected in a thorough manner. During the last few weeks many prospecting parties have left for outside points, in order to take in supplies when traveling is easiest.

The nickel mines of the Lake Superior Corporation, situated in the Sudbury district, are reported to have been sold to one of the Sudbury nickel companies.

Sudbury, Ont

Apr. 6—A considerable change has occurred in the general situation in this district since last season. Up to that time there had been only two strong, active companies in the field, the International and the Mond companies. The Booth interests, of Ottawa, had large holdings on the north range. The other properties were in the hands of local men or under control of companies with small available capital. The efforts of other companies to enter the field have heretofore been frustrated.

In the early autumn of 1911, several negotiations were undertaken by interests which claim to represent Mackenzie & Mann, and options on the Murray, Kirkwood and other mines were taken. Later other strong interests, presumably allied with a large American company, appeared in the field, seeking options and making investigations. It is difficult to tell just what this company has secured in the field, but it is known that its agents are investigating the nickel situation from the standpoint of availability of properties and of the metallurgical phases.

Since Jan. 1, agents of a German metal firm of international standing, have been seeking options in the Sudbury field. The result of this new life in the nickel business has been to take from the market a number of properties which were seeking buyers, and to give some hope of independent operations in the district. It has been known for some time that the International Nickel Co. controls the sale of the output of the Mond company, thus giving these two strong companies practically a monopoly in the nickel market, and with their large holdings and rich mines there was little inducement for either of them to buy any of the outside prospects.

A mining engineer who has made a careful study of the Sudbury district, considers that the opportunities for developing mines outside of those now known, are excellent. It is expected that some of the recent activities will lead to an intelligent and extensive exploration of the ore contact, which approximately represents the circumference of an elongated bowl, 30 miles long and 16 miles wide. It is understood that active drilling will be commenced soon, and the exploration in the district for the coming season is expected to exceed that of any previous year.

Porcupine

Apr. 5—The opening of the Dome 40-stamp mill, at Porcupine, on Mar. 30, was made the occasion of a public celebration under the auspices of the South Porcupine Board of Trade. A large number of invitations were sent out, in response to which many mining men, and others from a distance, attended. All the directors of the Dome were present and the mine and mill were thrown open to visitors, several hundred of whom witnessed the dropping of the stamps. Parades, bonfires and public entertainments were features of the celebration, and in the evening a banquet was held at the Majestic Theater, in honor of the visitors, at which Ambrose Monell, president of the Dome, reviewed the history of the mine and outlined the position and prospects of the enterprise.

In the course of his address, which was marked by a distinctly conservative tone, he said that as to the outlook for the camp there is no reason to believe that the orebodies are contained in only a few properties. The development already accomplished has placed the camp farther ahead in the same space of time as regards future possibilities, than any other camp he has known. Charles W. Merrill, of San Francisco, the designer of the Dome mill, said that after a study of conditions in Porcupine he has come to the conclusion that there are few districts superior for the economical extraction of gold from its ores. Porcupine has abundance of water, and its labor is of a comparatively high class. Not only are conditions favorable for high extraction, but the ore itself is one of the best that it has ever been his experience to meet with. As to the results of the Dome mill, they have not gone far enough to enable him to make a positive prediction, but he believes it safe to say that the mill will make a recovery of not less than 95 per cent.

The Mining News

The Current History of Mining

Alaska

Fairbanks District

About $2400 per week are being cleaned up from the 5-stamp mill at the Rhoades mine. The vein varies from 6 to 30 in. in width.

Newsboy—The 5-stamp mill will commence running about May 1. The shaft is now past the 300-ft. level. The vein is 4½ ft. wide and will average $40 per ton.

Newsboy Extension—The 5-stamp mill is being completed at the foundry of Brumbagh & Hamilton. The mortar is the largest casting ever undertaken in Alaska. Mr. McGillvrey and Walter Fisher are the lessees.

Spalding—Captain Spalding recently made a trial run of the 3-stamp mill which he has been erecting at this mine. Water for the mill will be pumped from the shaft until the spring thaw. The mill will work on $100 ore.

Alaska-Treadwell—During February, 62,020 tons of ore were crushed, yielding $130,050 gross and net $26,595. Operating expenses were $88,391; construction $15,064; development, 1020 ft. The ore averaged $2.11 per ton.

Arizona

Cochise County

Arizona United—On this property, at Johnson, the 720-ft. level is being advanced to cut the contact ore zone. Recently copper ore of good grade was encountered in the face. The other development consists of a shaft inclined at 40° 820 ft. deep and several crosscuts in the foot wall of the shaft. The present developments confirm the claim that the shaft was sunk under the contact, which it appears has a dip of about 30°. Last year ore was taken from 820 ft. in the shaft, which is below the water level in the district.

Gila County

It is reported that the American Smelting & Refining Co. is securing options on low-grade copper prospects near Christmas, a town about 25 miles south of Globe.

Inspiration—The experimental mill has been started again and J. M. Callow is conducting another set of tests. The trestle connecting the portal of the main tunnel with the site of the new steel warehouse is nearly completed. Engineers are working on plans for the mill and development of the orebody.

Barney—Churn-drill hole No. 2 is 420 ft. deep. A road is being built to the site of hole No. 3, which will be a union hole, drilled at the junction with the Live Oak and Southwestern Miami properties, the expense to be shared equally by the three companies.

Superior & Boston—Development work continues on the 12th level. Drifting is being done on the Great Eastern vein east and west of the north crosscut, and the driving of the crosscut to the southeast of the shaft continues.

Needles—The Guggenheim interests have acquired options on this group of claims in the Miami district, and will do some drilling. These claims are west of the Barney group, now being explored by the General Development Co., and northwest of the Schulze group, about to be drilled by the South Live Oak Development Company.

Southwestern Miami—There are continued reports that ore is being found in the holes being drilled by this company.

Miami—The annual stockholders' meeting will be held in New York on Apr. 17.

Maricopa County

It is reported that Colonel Dravo will soon undertake operations on his property in the Gold Camp district. The Mexican mill has been dismantled and the property abandoned.

Maschacerty—This mine is idle. It has a 60-stamp mill.

Santa Cruz County

Pioneer—Word is being sent out that this smeltery, about 20 miles south of Tucson, is ready to sample and buy copper ores. The freight on the lowest grade of ore from Patagonia is $1.50 per ton, and from Calabases and intermediate points, $1 per ton. The latter rate will apply to shipments from Calletano and the Santa Rita Ranges.

R. R. R.—This mine, in the Patagonia Mountains, shipped five cars of ore running 15% copper last autumn. The owners, R. R. Richardson and N. E. Crepin, started a tunnel to strike the ore 125 ft. below the lowest shaft, and encountered it at a distance of 500 ft., opening considerable high-grade chalcocite ore. Several men were negotiating for the mine before the ore was struck and it is thought that interests connected with the Shannon Copper Co. have secured the mine. This is the most important strike made in the Patagonia Mountains since the famous World's Fair mine.

California

Amador County

South Jackson—The machinery for the hoist and other surface equipment has been received, and the work of construction is in progress.

Poundstone—The new 20-stamp mill is expected to begin crushing ore about Apr. 15. The mill was built by the D. D. Demarest Co., in the Pacific shops at Altaville, Calaveras County. The stamps weigh 1050 lb. each and are rated to drop 100 times per min. The East Eureka Mining Co. is owner, and E. A. Davis, of San Francisco, is manager.

Calaveras County

Nuner—A recent cleanup of the waste dump at this gravel mine on Stockton Hill, near Mokelumne Hill, yielded $30 per 6-hr. day for six days. This is one of the gravel mines that were operated with inadequate methods. C. G. Nuner is owner.

Eldorado County

Natomas Consolidated—This and the Natomas Land & Mining Co. have filed deeds conveying to the Natomas Water Co. an extensive system of ditches, dams, reservoirs, water rights and other rights.

Fresno County

Valley Oil Co.—The 3400-ft. well in the town limits of Coalinga came in with a flow of 400 to 500 bbl. per day. It is the deepest well in the field and has cost $108,000 and consumed three years in drilling. The oil is 17.4 gravity. L. P. Timmins and others, of Fresno, are the owners.

Inyo County

Wilshire-Bishop Creek—A new 10-stamp mill has been ordered from the Traylor Engineering & Manufacturing Co. for delivery in May. The method of treatment contemplated includes coarse crushing, regrinding and cyanidation. The initial power will be direct water power.

Modoc County

It is expected that there will be a stampede into the new camp of High Grade, beginning about May 1. A correspondent in Nevada writes us that there are many inquiries about the new camp, especially from Colorado and that a special train is scheduled to leave Denver on Apr. 15 for High Grade. He says that he has seen specimens of some of the prospects there, which specimens look all right, but he has no first-hand information.

NEVADA COUNTY

Brandy City—The gold-saving apparatus installed on trial by the Automatic Gold Separator, Ltd., of Los Angeles, is reported to be in successful operation at these hydraulic mines, owned by the Hydraulic Mines Co. The company operates six giants. The separator operates on the tailings.

PLUMAS COUNTY

Gold Leaf—This prospect, in the Argentine district, has been bonded to the Feather River Consolidated Mines Co., a new incorporation organized by Cripple Creek, Colo., men. The 5-stamp mill at the Bluff City mine will be moved, and used at this property. Should the development warrant, new stamps will be added.

SANTA BARBARA

Palmer-Union-Blochman—No. 4 well is flowing 1200 bbl. per day. No. 5 well is being cleaned out, and the indications are for a good producer. No. 6 is in the oil sand.

SHASTA COUNTY

It is said that the results of experiments warrant the installation of the three additional electric furnaces, contemplated for some time past, for smelting iron ore at Heroult. The samples of pig iron recently produced are said to be of good quality.

SIERRA COUNTY

Snowden Hill—Good gravel has recently been uncovered at this mine near Mountain House.

Blue Channel—Kinnenberg Brothers have resumed work on this gravel property, near Downieville.

Sovereign—Ore crushing has been resumed here after a two weeks' shutdown for mill repairs.

Rainbow—An air compressor and machine drills have just been installed at this mine and work will be rushed.

SISKIYOU COUNTY

Blue Ledge—This copper property of 27 claims, in the Siskiyou Range, has been sold by Robert S. Towne, of 52 Beaver St., New York, to the Compañia Metalurgica Mexicana, of the same address. Patents were secured in January. A large sum has been spent in development. A smeltery is contemplated, but the situation has not been decided upon.

TEHAMA COUNTY

Northern California Gold Mining Co.—The suction dredge built by this company at Jelly Ferry, 14 miles from Red Bluff, is about ready for operation. It differs from the ordinary suction dredge and is provided with a digger attached to the suction drum, the invention of Victor A. Strom, of Alameda. The company has 270 acres of placer ground about 40 ft. deep.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Grand Republic—A group of 13 claims, with an area of 140 acres, about one mile southwest of the portal of the deep drainage tunnel, is owned by this company and a contract for sinking the Little Stella shaft from 90 to 210 ft., has been let to Calloway & McClain. The veins carry gold and copper.

CRIPPLE CREEK DISTRICT

Jennie Sample—W. Millar & Co., of Victor, have secured a three years' lease, and the plant at the mine shaft has been started again.

Hillside—A five years' lease on this mine, on Womac Hill, owned by the Erie Mines Co., of Buffalo, N. Y., has been given to R. D. Lambert, of Cripple Creek.

Vindicator—During March the mine shipped 130 cars of ore.

El Paso—The output of this Beacon Hill mine for March was 100 cars of ore.

American Eagles—The output for March was about 17 cars of $60 ore.

Elkton—This mine is reported to be shipping about 2500 tons per month of 1-oz gold ore.

Granite—At the 800 level of the Gold Coin shaft, on the Dorothy vein of this company, 2 ft. of rich sylvanite ore have been opened.

Cripple Creek Consolidated — The charter has been renewed for 20 years. J. F. Humphrey, of Colorado Springs, is president.

Amazon—This company has been reincorporated for 20 years. F. G. Peck, of Colorado Springs, is president.

School Section—A supposedly poor vein, opened years ago, has been explored by Superintendent Montague, and 3 ft. of $20 ore have been opened.

LAKE COUNTY—LEADVILLE

Lucerne—The mine, near the head of East Fifth Street, has been leased by Thomas Simpson, who is cleaning out the old workings, retimbering and installing an electric hoist.

Lovejoy—Prospecting by crosscuts and upraises from this tunnel is being done by J. Clarence Hersey, and small streaks of good ore are being worked. The tunnel is now in 1000 ft., the breast being under the crest of the hill, which divides California and Iowa Gulches.

Hellena—The 40-ton experimental mill is completed and will be started soon. If successful the capacity will be increased. Mine and dump ore will be treated and there are between 1500 and 2000 tons of the latter.

Rattling Jack—Regular shipments of carbonate-of-zinc ore are being made by the lessees.

Sugar Loaf Consolidated—The breast of the tunnel and three raises are all in silver-lead ore. The tunnel is now in 3800 ft. and the raises connect with the old Sherill vein.

OURAY COUNTY

It is stated that the pyritic smeltery at Ouray, will begin operation May 1, as all the stock in the company has been subscribed for, payable during April. Col. Thomas B. Crawford, of Denver, is president.

Red Mountain Reduction, Refining & Smelting—This company, which owns most of the early paying mines in the Red Mountain district, in the vicinity of Ironton, is to be reorganized, and at a meeting held in Philadelphia, Feb. 8, it was proposed to form a new company with a capital stock of 5,750,000 shares, $1 par value. The company owns the Guston, Yankee Girl, Tennessee, Vanderbilt, Joker Tunnel and other properties.

SAN JUAN REGION

Tomboy — During March the mill crushed 9600 tons of ore, yielding bullion $35,000, and concentrates, $44,000. Expenses were $47,000 and profit $32,500; $2480 were spent on permanent improvements.

Idaho

BOISE COUNTY

The Government suits against the Barber Lumber Co. have been settled. The large sawmill on the Boise River, five miles above Boise, has been closed for several years pending the settlement of these suits. While the company has given out no information as to its plans, it is expected that a railroad will be built into this district soon. This is looked forward to by owners of lode claims, and will probably be the signal for renewed activity in mining in that district.

Moline—This company, which has been operating a 5-ft. Risdon dredge near Placerville, has exhausted its ground and is dismantling its boat.

Boston & Idaho—The new boat of this company on Moore Creek, is making a record of about 8000 yd. per 24 hr. The company has 20 men reopening the Banner mine, 20 miles east of Idaho City, preparatory to sampling.

COEUR D'ALENE DISTRICT

Bear Top-Orofino—The faulted part of the vein, lost two years ago, has been discovered, after an expenditure of about $25,000. The vein was found in a crosscut from the lower tunnel. A drift has been run on it, since, and has been in low-grade milling ore until recently, when an orebody 8 ft. wide was cut. The depth at this point is about 630 ft. The mill has been turning out 18 tons of concentrates per day, and a 50-ton car was shipped recently.

Amy—This property has made its initial shipment of two cars of ore. The mine is in the Pine Creek district and has excellent prospects.

Vulcan—Work is to be resumed at this property. The mild weather has melted the snow and there is plenty of water to run the compressor. The tunnel is in 2600 ft. The work will be done by day labor, at least until the vein is cut.

Guelph—This company, operating near Burke, has contracted for 100 ft. of tunnel, to be driven immediately.

Carney—Some fine specimens of bornite were brought to Wallace from this property, near Mullan. The vein is said to contain a quantity of finely divided mineral besides streaks of coarser material, from which the specimens were obtained.

Illinois

It is expected that the pottery of the smelting works of the American Zinc, Lead & Smelting Co., at Hillsboro, will be completed about the middle of this month. A Garrison-Whipple condenser machine is to be installed. It is expected that the plant will be ready to begin smelting with three blocks of furnaces about the end of the summer.

It is understood that the International Smelting & Refining Co.'s plant at East Chicago, Ind., will stand on 151st St., between Alexander Ave. and the new canal. This will be just across from the Goldschmidt Detinning Co.'s plant.

The Granby Mining & Smelting Co. has begun the construction of its new smelting works at Rose Lake, in East St. Louis, Illinois.

Michigan

Copper

New Arcadian—This company has two drills in operation. One is drilling hole No. 23 in the horizon of the Baltic formation; this hole is down about 890 ft. The other drill is working near the Franklin boundary line in Section Nine.

Mass—An improvement has occurred in the grade of the rock in B shaft, especially in the 13th level drift. The hoisting equipment at C shaft is being erected and the new rockhouse is about completed. Unless something unforseen occurs, this property will be in shape to double production by June 1. At present, shipments amount to about 350 tons of rock per day.

Indiana—The vertical shaft is down about 700 feet.

Superior—The West lode, which was first encountered a few months ago, a short distance from the hanging wall of the main lode in the lower levels, has been exposed at all levels from the 12th to the 17th, and is opening ground that will be of material benefit to the property; in some places it is especially rich.

Allouez—The structural steel of the new rockhouse at No. 2 shaft has been erected and the permanent equipment is being finished. It is expected that by June 1, this shaft will be in regular commission.

Old Colony—The second drill has been received and will be placed in commission soon. The present drill continues hole No. 13-A, but it is operating in a badly shattered formation, which may necessitate the discontinuance of the hole.

North Lake—The report for the year ended Dec. 31, 1911, shows total expenses of $20,923. It is stated that the results of diamond-drill holes Nos. 3, 7 and 13 indicate that some promising veins run through the property and that No. 3 hole is the most desirable place to commence active mining work. The shaft will be sunk vertically and all lodes showing copper will be thoroughly explored by a crosscut at a depth of about 1000 feet.

South Side—Stockholders voted recently to sell the property to the Naumkeag Copper Co., for $22,515 cash and 7740 shares of the latter company, issued at $10 per share.

Union Copper Land & Mining Co.—The report for 1911 shows $8670 cash on hand at the end of the year. No. 5 hole was sunk 1439 ft. vertically with favorable results and was followed by Nos. 6, 7 and 8 holes. In three holes a copper-bearing amygdaloid was disclosed, which President Fay states is of commercial value and apparently identical with the Quincy-Pewabic lode.

Copper Range—Extensive improvements are being made in the regrinding department of the company's stamp mills. Some of the devices used by the Calumet & Hecla company in its mills at Lake Linden will be adopted.

Iron

Zimmerman—At this mine of the Spring Valley Iron Co., in the Iron River district, preparations are being made to increase the output. A new steel shafthouse has recently been completed by the Wisconsin Bridge & Iron Co., at shaft No. 2, and a large gyratory ore crusher installed. A new engine house and boiler houses have been erected, and a 25-drill Ingersoll-Rand air compressor set up. Forty underground tram cars have been purchased of the Lake Shore Engine Works, and a drill sharpener of the Ingersoll-Rand company.

Republic Iron Co.—At the mines of this company, at Republic, hoisting of ore is now in progress through three shafts. Changes in underground practice at this mine have been adopted; water drills with hollow drill-steel have been successful in allaying the dust caused by drilling in the hard formation; carbide lamps have been adopted by all miners, each of whom buys his own lamp, the company furnishing the carbide. Carbide has been found to give a better and cheaper light.

Penn Iron Mining Co.—At the mines of this company, at Vulcan, a new electric hoist has been constructed by the company's engineers. The drum was purchased from the Lake Shore Engine Works, and the motor from the General Electric Co.

Minnesota

Mesabi Range

Grace—This mine, recently acquired by the Inland Steel Co., has been pumped out and will be a shipper this season, as will also the company's Laura mine.

Norman—Newspaper dispatches state that the fee-owners of this mine have filed a cancellation of the lease, under which the Steel Corporation is operating the property, alleging mismanagement.

Leonard—Work has been pushed all winter, even to the extent of stockpiling pit ore, and it is understood that shipments are being planned to reach 2,000,000 tons this season. The mine is operated by the Oliver company, and is one of the Hill leases.

Montana

Butte District

Anaconda—At the Tramway mine, on Friday, Mar. 29, the engineer pulled a skip of ore into the sheave wheels, causing the wreck of the hoisting and chippy-cage compartment sheave wheels, and forcing the immediate temporary suspension of operations. A safety device has been used for the last two years at all of the principal hoisting shafts, which is supposed automatically to shut off the engine before the skip reaches the sheave wheels; in this case, however, it failed to work. The chippy cage, being lowered at the time, fell a few feet and was caught by the dogs on the safety catches. The skip in the other compartment was practically at the bottom of the shaft, and fell only a few feet.

Tuolumne—The raise from the 1800-ft. level to the North Butte company's workings, 200 ft. above, has recently holed in, and the level is now being supplied with an abundance of fresh air. Mining is showing good results on the 1800-ft. level, where a large vein of ore was recently opened, and on the 900-ft. level a good body of ore is being developed by drifting. About 150 tons per day of 7% ore were shipped to the Washoe smeltery during March, and this output will be about doubled soon. It is expected that negotiations with the Anaconda company for the treatment of second-class ore will be settled soon with mutual satisfaction. This will permit mining and shipping of the second-class ore blocked out but as yet untouched. Shaft sinking will be con-

tinued soon to the 2000-ft. level, where development work will be started.

Butte & London—On Mar. 29, the machine and blacksmith shops were destroyed by fire, entailing a loss of $5000, not covered by insurance. No damage was done to the shaft. The machinery was removed in April, 1908, when the property was closed down.

Jefferson County

Baltimore—Charles Whitcomb, of Helena, has secured a lease on this mine, near Boulder, and has 50 men at work. He is shipping about 50 tons of ore per day to the East Helena smeltery. The mine is worked by a tunnel about 600 ft. long.

Corbin Copper Co.—During 1911 drifting, crosscutting, sinking and raising were done as follows: Bonanza tunnel drifts, 1068 ft.; raises, 405; sinking, 75; stoping, 18,671 cu.ft.; Rosalie tunnel drifts, 707 ft.; raises, 58; stoping, 572 cu.ft.; Dow and Kathleen tunnels, 429 ft. of drifts and crosscuts. Ore has been found in several of the tunnels. A power line was built to the concentrator, and a Sullivan compressor installed.

Robert Emmet—A strike of good silver-lead ore was made recently on the 500-ft. level of this mine in the Amazon district. A crosscut was driven 150 ft. from the shaft, and it found the vein to be 18 ft. wide. Electrical machinery has been installed. The company also owns and operates the Blue Bird mine, near Wickes, both properties being under the management of W. Q. Ranft, of Missoula.

Madison County

Nelson—This mine, near Virginia City, operated under lease with S. H. Ribbel as manager, will soon hoist ore. The Shafter mill, near the property, is being placed in condition to treat the ore. Mr. Ribbel is confident of being able to mine sufficient ore to keep the mill running steadily.

Missoula County

Monitor—Preparations are being made to drive a tunnel from the Milwaukee railroad tracks into the property, near Saltese, to tap the vein at a calculated distance of 6800 ft. from the mouth, and at a depth of 2160 ft. Copper ore worth $300,000 is said to have been shipped from this mine, the lowest level at present being the 700-ft. The ore carries both copper and gold.

Ravalli County

Montana Mines—A lease and bond has been taken on a group of gold claims on Eight Mile Creek, six miles east of Florence, in the Bitter Root Valley, by the Montana Mines Co. There are three claims in the group and on two of them, the Providence and Dunstant, considerable development has been done.

Nevada

Clark County

Duplex—Crosscutting is underway on this property adjoining the Quartette, to cut the I. X. L. vein, and exploration is being done on the New Year's Gift vein.

Chief of the Hills—This mine in the Fourth of July Mountains, four miles east of Searchlight, is being actively operated under lease by Messrs Hoine and Ray.

Bamberger-Wheatley—The Sara Nevada mine in the Fourth of July Range, belonging to this company, has been leased to John Howe and is producing. The Copper Belle, owned by the same interests, is also being operated, a new orebody having been found recently.

Comstock Lode

Ophir—A shipment of 34 tons of concentrates was made last week, the gross assay value being $27,000. This was the cleanup from a run of 2000 tons at the Kinkead mill. An average of the daily run shows a high percentage of extraction obtained.

Con. Virginia—The management has decided that on May 1, the accumulated ore from the 3-compartment raise on the 2400-ft. level will be milled at the Kinkead mill. The raise is being carried along the footwall, and the ore saved has averaged between $30 and $40 per ton. The proceeds will be applied on the development and exploration work.

Union Consolidated—The new pumping plant on the 2250-ft. level of the joint winze is working successfully. The company will start two prospecting drifts from the 2500-ft. level. One will follow the footwall of the vein in a southerly direction, and the other will be driven north on the hanging wall to the Sierra Nevada ground. This vein formation is promising, and is east of any exploration work ever done on the Comstock lode.

Lyon County

Nevada-Douglas—This company is reported to have 260 men on its payroll and to be contemplating an increase. The last payment on the Ludwig property has been made.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Mar. 28, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,250	42,869
Tonopah-Belmont	2,100	28,726
Montana-Tonopah	1,014	12,871
Tonopah Extension	1,065	11,967
West End	750	9,049
Midway	.....	180
MacNamara	365	3,672
North Star	.....	40
Totals	8,544	109,154
Estimated value	$213,600	.....

Tonopah Extension—The March production was 4618 tons, yielding bullion worth $55,300, the 30-stamp mill having treated an average of 149 tons of ore per day. In the eastern workings on the 400-ft. level, a faulted oreshoot has been found and carries high-grade ore.

Jumping Jack Merger Mines Co.—It is reported that this company is being formed to acquire and operate the Jumping Jack, Stray Dog and Indian Camp properties.

Montana-Tonopah—The company milled 4748 tons in March and the net profits for the month will probably exceed $35,000. The downward extension of the Shaft vein has now been cut on the 465- and 515-ft. levels, and at the latter has been drifted on for 75 ft. It is from 5 to 6 ft. wide and averages over $50 per ton. In crosscutting for it on the 565-ft. level, a new 3-ft. vein of $40 ore was cut.

West End—The west drift on the 500-ft. level shows over 20 ft. of $20 ore. The oreshoot in the extreme eastern workings is 8 ft. wide of good ore. The mill is treating 750 tons per week, almost solely from development of different oreshoots.

Tonopah-Belmont—The company has cut a new vein on the 12th level. The new Silver State vein, cut two weeks ago on the 11th level, is 9 ft. wide, all good milling ore. The east drift on the Lillie Belle vein shows nearly 3 ft. of smelting-grade ore. Ore pockets are now being cut in the shaft on the 13th level, and when completed, sinking will be resumed.

MacNamara—The March output was worth $18,300. The cyanide plant has been equipped with Trent agitators and the mill is treating 65 tons per day, the ore averaging $17 per ton.

Washoe County

In the Wedekind district, near Reno, three hoists are at work, all sinking. The Arkell shaft is down about 168 ft. and the Roop shaft is down about 190 ft.

New Mexico

Grant County

Oro Grande—This property, sometimes referred to as the "Apache Box," consists of 11 unpatented claims and a millsite, in the Steeple Rock district, being reached by wagon road, 12 miles from York, a station on the Arizona-New Mexico R.R. An examination recently made shows five wide veins of low-grade gold-silver ore. An engineer who visited the property has informed us that it is an important prospect.

Socorro County

George Utter will soon ship another car of zinc concentrates to Oklahoma. He receives $22.50 per ton, f.o.b. Silver City, for concentrates running 40% zinc.

Deep Down—The new gasoline hoist has been installed and the mine force in-

creased, both property and equipment now being in readiness to make regular daily deliveries of ore to the Deadwood mill.

Ernestine—The new Blake crusher has been shipped from the factory. In March the mill treated 3200 tons of ore.

Oaks—During March 133 ft. of development were done at the Pacific mine, producing 75 tons of ore, which will be packed to the Deadwood mill for treatment as soon as the custom orebins at the latter have been emptied.

Trilby—In the course of recent development work on this group a considerable tonnage of ore was accumulated and is now being transported to the Deadwood mill. Should the results be satisfactory, it is likely a lease will be let and further development inaugurated.

Deadwood—The repairs on the engine have been made. During the unavoidable closedown, a large tonnage of custom ore has accumulated.

Ozark Smelting & Mining Co.—This company is going to build a concentrating mill at Magdalena. Philip Argall & Sons, Denver, Colo., are consulting engineers.

Oregon

Jackson County

Governor—This mine, formerly owned by E. H. Pierce, has been sold to Messrs. Bowling, Jones and associates, of Medford. The new owners expect to begin shipping ore soon.

Little Daisy—D. G. Greger, of Salem, recently purchased this property at Takima, and development work is to be started.

Oregon Strong Ledge—A chlorination plant has been installed on this property, at Applegate, giving the mine a capacity of 100 tons per day.

Reddy-Lewis—A contract has been let by Dr. John F. Reddy, Medford, owner of this property, for another tunnel to be 100 ft. long.

South Dakota

Black Hills District

Evans Consolidated—C. C. Forester, who has been appointed general manager of this property, has been engaged in a thorough examination to ascertain the extent and grade of the orebodies. Several hundred assays have been made. He is at present in Denver, where he took some large samples for laboratory tests on mill methods. Pending these results, the work of mill construction has been postponed.

Texas

Brown Ore Development Co.—This company, at Ore City, has taken options on 28,000 acres of land in Upshur, Marion, Cass and Morris Counties. Explorations for iron ore have been going on for some time under charge of L. C. Luckel. The company, in which Charles M. Schwab is interested, is opening a large mine at Ore City.

Utah

Beaver County

South Utah—During February, 283,838 lb. copper were produced. There were milled 21,472 tons of ore, yielding 1641 tons of concentrates, the ratio of concentration being 13.43: 1. Fifty-two tons of 13.42% copper ore were shipped. Costs were lowered and the grade of the ore milled increased, averaging 1¼% copper, with some gold and silver. The ore at present being treated runs 1½% copper.

Majestic—The gallows frame and buildings containing the dynamo, compressor and engine, at the Harrington-Hickory, were destroyed by fire recently.

Moscow—On the upper levels old stopes are being worked, and new ground will be developed. The monthly output is about four cars of ore, worth $1000 per car. Twenty men are employed.

Juab County

Tintic shipments for the week ended Mar. 29 were 182 cars.

Swansea—An improvement is reported in the shipping ore from the 940-ft. level, and sulphides, in which there is some galena, are said to be taking the place of oxidized iron.

Opohongo—A donkey engine will be installed to be used in continuing the winze below the 700-ft. level.

Tintic Mining & Development—An electric hoist and gallows frame will be installed on the tunnel level. The intention is to sink the shaft to the 500-ft. level before drifting.

Iron Blossom—Good copper ore has been opened on the 600-ft. level, and a winze sunk 50 ft. in ore below this level. It is stated that the management intends to prospect the fissure at depth.

Beck Tunnel—The March output was 20 cars of ore. Steady shipments are being made.

May Day—During the year ended Mar. 31, 1912, lease ore amounted to 3626 tons, and ore shipped on company account, 3372 tons. Receipts were $63,982 and expenditures $63,915. Conditions at the mine show much improvement over those at the end of the year preceding. Recently new ore has been discovered in three places. The mill has been closed down during the development of shipping ore.

Gold Chain—The orebody, found on the 200 level, has been drifted on for over 150 ft. on the 400 level. The same vein has been opened on the 700, where a winze has been sunk 50 ft. in ore. The ore is stated to assay about $25 per ton.

Summit County

Thompson-Quincy—A heavy flow of water has made timbering necessary. The water is regarded as an indication that the limestone contact is not far distant. There is some high-grade ore in the face of the drift.

Daly-Judge—The company has arranged for the disposal of its zinc middlings and shipments have been resumed. On Jan. 1, 1136 tons of zinc middlings were in storage, having been allowed to accumulate since October. The zinc tables are yielding an improved product, the grade having increased from 30% to 40 or 45 per cent.

Utah County

Eureka Leasing & Mining—There is a 900-ft. tunnel on this property, in the Santaquin district, giving a depth of 500 ft. A good-sized orebody was recently opened.

Eva—This property is three miles north of the Eureka Leasing; an incline shaft has been sunk 550 ft., mostly in lead-silver ore.

Nebo Highland—About 10 days ago a snowslide swept away the cabins on this property, half a mile north of the Eva. No work has been done since. Ore has been opened in the 300-ft. inclined shaft.

Virginia

Old Dominion Sulphur Co.—The company has been incorporated to develop and mine a deposit of pyrites in Stafford County, 10 miles from Fredericksburg. The officers are: President, Albert Fogg, Camden, N. J.; vice-president, C. C. Watton, Norfolk, Va.; secretary and treasurer, W. Sparkling, Petersburg, Va. The property owned covers about 300 acres.

Washington

Ferry County

The following companies in the Republic district have recently installed Oliver filters, with reported success: Rathvon Reduction Works, North Yakima Power & Reduction Co., San Poil Mining Co., and British Columbia Copper Co. Attempts to cyanide these ores have usually failed, partly through difficulty in filtering the pulp, but this type of filter is said to have been successful in this work.

The smeltery returns for January and February show that the ore shipments from the Republic mines during that time aggregated 7222 tons as follows: Republic Mines Corporation, 5195 tons; Insurgent, 252; San Poil, 604; Quilp, 91; Knob Hill, 1080 tons.

North San Poil—A new orebody has been encountered at this mine, assaying $35 per ton. Operations are to be enlarged under James W. Taylor, Republic, who is manager.

Canada

British Columbia

Granby—Eight furnaces are in operation at the Grand Forks plant, and about 3500 tons of ore per day are being produced from the Phœnix properties. No decision has been reached yet for equipping the Hidden Creek mine.

Ontario

The Black Jack and Gold Hill mines, in the Lake-of-the-Woods district, are to be reopened by the owner, Bannell Sawyer. A 3-stamp mill is to be installed.

Ontario—Cobalt

Cobalt shipments for the week ended Apr. 5 were: Coniagas, 184,400 lb.; McKinley-Darragh, 137,980; Cobalt Townsite, 78,000; La Rose, 77,338; Nipissing, 65,112; Cobalt Lake, 65,500; Buffalo, 56,635; Temiskaming, 54,934; Trethewey, 53,000; Crown Reserve, 42,130; total, 813,079 lb. Bullion shipments were: Nipissing, 24,875 oz.; Crown Reserve, 22,234; total, 47,109 ounces.

The Dominion Safety Explosives Co. will build a factory on Peterson Lake, for the manufacture of its explosives. Several of the directors of the Cobalt Lake mine are interested in this new project. The product of the company is Dinitrolite, an explosive which has been used at the Cobalt Lake mine for several months, and which is stated to have given entire satisfaction. A feature of this explosive is its unusual safety.

Nipissing—The annual report for 1911 is expected to show net earnings in excess of $2,000,000. The production was about 5,200,000 oz. of silver, at a cost of about 14c. per lb., comparing with 14.72c. for the previous year. Less development was done, but high-grade reserves were increased.

Casey—A report to the stockholders states that work is being done on a true fissure vein, which has been drifted on for 17 ft. It is nearly 10 in. wide and is stated to have produced ore running from 6200 to 10,000 oz. per ton.

Ontario—Porcupine

Roche—Trenching has disclosed a new vein of quartz about 3 ft. wide.

Crown Chartered—This company will install a 10-stamp mill as soon as machinery can be delivered. The west crosscut on the 100-ft. level has been run through 16 ft. of ore, and the raises from this level pass through rich ore.

Kelso—A shipment of 700 tons of nickel ore is being made from this mine, situated 2½ miles from Iroquois Falls, in Clergue Township. The ore will be treated at the Summit smeltery, in Pennsylvania, and was taken from a 5-ft. vein, on which the shaft is down 45 ft. It will be put down to the 100-ft. level, and drifting done to test the length of the orebody. In places the vein carries a high percentage of nickel, but the general average is low.

Hollinger—No. 4 vein has been cut on the 200-ft. level, where it shows a width of 4 ft. of quartz. This increases the amount of ore estimated for this vein in the annual report.

McIntyre—A new vein has been encountered on the 200-ft. level, from No. 1 shaft. The crosscut is in 15 ft., and the center of the vein shows a good streak of high-grade ore.

Three Nations—A blind vein, 15 in. wide and carrying free gold, has been opened in the crosscut at the 100-ft. level.

Ontario-Sudbury

Wahnapitae Power Co.—The flume burst on Apr. 1 and the water rushed through the power house, wrecking some of the machinery and nearly drowning the three attendants. It will be nearly a month before the plant will be in running order again, and in the meantime the Garson mine of the Mond Nickel Co., the Whistle mine of the Dominion Nickel-Copper Co., the Moose Mt. mine and the city of Sudbury will be without power or lights.

Mexico

Chihuahua

San Toy—This company is continuing explorations from the bottom levels of the Central shaft which, in December, 1911, was deepened to the 1400-ft. level, at which depth the ore-bearing limestone stratum of the district was reached. A level has been driven north nearly to the property line and extensive diamond-drilling done in an effort to find an orebody at the deeper horizon, but so far without results. The ore already opened was between the 460- and the 660-ft. levels and disappeared at 800. The company was making large shipments until the interruption of railroad service by the insurrection in February, the ore going to Torreon. The stock is largely held in Pittsburg, where the company was financed under the direction of Charles M. Schwab. Donald B. Gillies is president.

Hidalgo

Cortez—Operations during 1911 are said to have been satisfactory. The financial statement on Dec. 31, 1911, shows: Buildings and improvements, $2804; development, construction and exploration, $95,238; loans, $20,000; cash, $103,042 and $128,018 excess of current assets. Olof Wenstrom is consulting engineer and general manager.

Oaxaca

Compañia Minera de Santa Lucia—Work has been permanently suspended at the property near San Geronimo. The zone of enrichment was passed and ore was entered at ground-water level. The ore at this point was insufficient to develop a low-grade mine and transportation is by mule-back 90 miles to the railroad. The shutdown was not due to revolutionary troubles.

San Luis Potosi

Tin deposits near San Luis Potosi have been examined for English interests, represented by F. A. Kesselhurth, an option on the property having been taken. Other tin explorations are planned.

Tepic

Purisima—Owing to an accident to the boiler, the mill has been temporarily shut down. It is intended to replace the steam plant by a gas-producer plant, to furnish power for the mill. Development work is being continued.

Zopilote—During February, a filter plant of local design and construction was installed, and another 75-ton masonry leaching tank has been added to the equipment of the cyanide plant. The addition of another Wilfley table to the concentrator permits of continuous operation of the reverberatory furnaces for treating the second-grade concentrates by the lixiviation process, affording a considerable saving over the former method of shipping this class of product to the smelteries.

South America

Chile

Braden—It is reported that some new methods of ore treatment are to be tested. Present operations will not be interfered with. The most important of these experiments is said to be one to be conducted by the Mineral Separation Ltd., of London, which is now erecting, at its own expense, a 250-ton plant for this purpose. Successful tests are said to have been made on the ore already, showing a high extraction. Good progress is being made on the Braden company's leaching plant. Two units of the concentrator are in operation and the third is being adjusted. More chilean mills will be added. Nos. 1 and 3 tunnels at the Teniente mine are advancing in good ore.

Africa

London dispatches state that petroleum has been discovered in the Mozambique district, in East Africa.

Asia

Chosen

Oriental—Cable dispatches state that the March cleanup was $127,000. Full returns for February show that the cleanup for that month amounted to $125,208. Two of the mills were closed in February, one all month and the Maibong since Feb. 21. The latter shut-down was caused by a flooding of the workings of the Chara mine, due to old workings cracking open under the river. Hoisting ceased as all available power was used for unwatering.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Apr. 10—Everything in the coal trade just at present is uncertain, depending entirely upon the labor situation. In the West the process of voting on the compromise agreement and the arrangement of district schedules are in progress. It seems to be generally expected that the compromise will be ratified, though as yet this is not certain. In the Pittsburg district the operators expect that work will be resumed in the mines about Apr. 22, but this may be postponed. The same conditions prevail in Ohio and Indiana.

In the anthracite region everything is closed down. The operators and miners meet in Philadelphia today, but the result of the conference is entirely uncertain and may not be known for two or three days. The wage question can probably be adjusted, but the trouble will be over the recognition of the union. There has been some friction locally over the question of repairs at the mines, but no serious differences.

The strike in Great Britain seems to be practically at an end, and the miners in most districts are gradually going to work.

Anthracite shipments in March were heavy, being 6,596,687 long tons, or 599,793 tons more than in March, 1911. For the three months ended Mar. 31 the total shipments were 16,971,959 tons in 1911, and 18,209,351 in 1912; an increase of 1,237,392 tons, or 7.3%, this year.

Austrian Coal Trade—Imports and exports of fuel in Austria Hungary, year ended Dec. 31, metric tons:

	Imports	Exports	Excess
Coal	11,872,928	609,737	Imp. 11,863,191
Brown coal	34,381	7,063,981	Exp. 7,029,600
Coke	702,707	299,915	Imp. 402,792
Briquets	56,597	133,918	Exp. 77,321
Total	12,666,613	8,107,551	Imp. 5,159,062

Imports are chiefly from Germany and Great Britain; exports mainly to Germany.

Iron Trade Review

New York, Apr. 10—The whole iron and steel market presents a better aspect. Specifications for steel products are coming in at a greater rate, shipments are heavier, and prices show a firming-up tendency. The majority of steel plants are operating at full capacity and have such an accumulation of specifications on hand that, with specifications coming in at such a good rate they regard full operations as assured until midsummer. Then the real test will come as to the new prices. The great bulk of the material was contracted for at low prices to July 1, and outside of odd lots bought from time to time the mills do not have a chance to benefit by the advanced prices until fresh contracts are made. It is the intention to interpret contracts strictly, and cancel everything unspecified by July 1. Even then, however, it will probably be found that many consumers and distributers will be stocked and will require smaller shipments for a while.

The pig-iron capacity of the country today is approximately 34,000,000 tons a year, counting as available capacity furnaces which operated when prices were higher than at present, but which would probably lose money at present prices. The present production rate is very close to 29,000,000 tons, making 85% of the capacity in operation. The steel-works furnaces are doing much better than the merchant furnaces, operating at close to 95% of capacity while the merchant furnaces are doing less than 75%. Idle merchant furnaces will hardly come into blast except at higher pig-iron prices, particularly when coke is so high priced. Connellsville furnace coke for shipment this week sells at $2.65, ovens, against $1.50 last November, while pig iron has advanced an average of only 25 cents.

Pig iron continues active and purchases are running now over into third quarter. Furnaces are generally asking advances on second-half contracts, but they are still apt to give way on good orders. There is, however, probably a range of 25 or 50c. higher on orders running well into second half.

Pig Iron Production—The monthly reports of the blast furnaces, as collected and published by the *Iron Age*, show that on April 1 there were 238 coke and anthracite stacks in blast, having an aggregate daily capacity of 77,900 tons; an increase of 4200 tons over March 1. Making allowance for the charcoal furnaces, the total production of pig iron in the United States in March is estimated at 2,428,800 long tons. For the three months ended March 31 it was 6,626,700 tons.

Baltimore

April 8—Exports for the week included 344,600 lb. galvanized pipe to London; 398,600 lb. iron pipe to Antwerp. Imports included 5183 tons cupreous pyrites from Huelva, Spain; 11,750 tons iron ore from Cuba.

Birmingham

Apr. 8—Holding pig iron at $11 per ton, No. 2 foundry, Southern manufacturers are not yet anxious for business for delivery during the last half of the year. Sales are being made for delivery during the third quarter under $11 per ton. It is even announced that before the first of the present month one of the large companies of this section sold a cast-iron pipe-making concern, 60,000 tons of iron, delivery to be made during the balance of the year. It is understood that the price for this product was under $10.50 per ton, No. 2 foundry basis. There is much business in sight but whether the consumers are going to pay the new price remains to be seen. The steel situation in the Southern territory is also improving, and it is announced there will be need for a fairly steady operation of the big rail mill of the Tennessee company at Ensley through the next three months at least, on orders in hand and in sight. Charcoal iron is holding $22@22.50 per ton, with no change in demand or in make.

Scrap iron is a little more active while the brass and bronze workers announce a decidedly better condition now than for some time past.

The iron manufacturers in the Southern territory are still figuring on concessions in the way of freight rates with no prospects of an early improvement in this line.

Chicago

Apr. 9—The iron and steel market has strengthened notably in the last week. Sales of pig iron have increased, several contracts having been made for last-half delivery, the tonnage of each of which is larger than of any contracts previously made this year—5000 to 10,000 tons. The buying is by the harvester manufacturing and other large interests. As a consequence, Southern No. 2 iron has advanced to $10.75@11, Birmingham—$15.10@15.35, Chicago—on general sales, while special lots bring $11.25, Birmingham. These prices represent an advance of 25@50c. over prices of a week ago. Northern No. 2 brings $14.50 at the furnace on the average, with some sales 25c. above or below this price. The demand is largely for Southern now, though it has increased for Northern and for Lake Superior charcoal iron, which sells for $16.50@17.50, the wide variation being due to different requirements of buy-

ers. There is still a large demand, in the aggregate, for small lots of pig iron, from general founders, who continue the policy of buying often and for a comparatively short time ahead.

In the finished-goods market the chief activity is in structural steel, which is selling largely for building and bridge requirements. The price now holds up well to 1.35c. minimum for material up to 15 in. on nearly all business. Railroad supplies are selling well in comparison with past weeks, with large rail contracts still few. Bars are in good demand but competition is still keen with Pittsburg and local production is in excess of needs. Soft-steel bars are quoted at 1.25@1.33c. and iron bars at 1.15@1.20c., Chicago. Billets are quiet at $27 for openhearth. Plates are in increasing demand for railroad needs, with 1.35c. minimum on ¼-in. tank plates. General business conditions are good with strength in many lines affecting the iron and steel market.

Cleveland

Apr. 8—Additional sales of ore are noted. Prices quoted have been generally adhered to, except that there is reported to have been some cuts in Old Range nonbessemer.

Pig Iron—A number of small sales are reported, but no large contracts. Prices, Cleveland delivery, are $15.15 for bessemer, $13.25@13.80 for No. 2 foundry, $12.50@12.75 for forge.

Finished Material—Specifications on contracts are large. New orders are chiefly small, but there are a good many of them. Prices are generally firmer.

Philadelphia

Apr. 10—More or less business in pig iron is temporarily held up on account of the firm attitude of makers. Large sales have been made in basic, foundry and malleable, but the transactions are below the indications of a week ago. The impression prevailed that some makers would accept business at concessions, but while there were two or three instances of weakness, the rest held out firmly for prices named in answer to inquiries. The activity in Western markets is reflected in the East, and it is believed that most of the business now pending will be closed on terms advantageous to makers. No. 2 foundry has done better than for several weeks. Low-grade foundry has advanced 25c. on recent contracts. Southern makers are asking a little more money and have squeezed some sales into this territory. The indications today are that quite a number of large New Jersey, New York and New England concerns will definitely and promptly close for iron, part of which will be scattered over third-quarter delivery. The smaller foundries are ignoring all signs and are buying all the iron they need and would be willing to pay more if they must when they want it. No. 2 X foundry is $15.25; gray forge, $14.25; basic, $14.50. Two or three brands of Southern gray forge are available at $13.75 per ton.

Steel Billets—Billets are in improved demand, among the smaller buyers whose stocks are practically exhausted, and forging billets are occupying most attention.

Bars—The movements in merchant bar are more active to large buyers and to the jobbing trade as usual at this time. Mills are well supplied with assortments, and orders are filled with promptness. The inquiries for common iron far exceed those for refined.

Sheets—The business booked for the week shows that the smaller buyers are in the market, and that they are looking ahead, placing more liberal orders for summer distribution.

Pipes and Tubes—A general improvement is reported in tubes.

Plates—Plate business does not present much activity, as measured by orders placed. Many quotations have been withdrawn; outside figures are now maintained, and no concessions will be considered.

Structural Material—Orders for shapes have fallen off as to local requirements, though there is quite a lot of business pending.

Scrap—The desirable grades of scrap are going quickly at holders' prices, and country supplies are pouring in.

Pittsburg

Apr. 9—The iron and steel trade is exceedingly active, mills operating close up to full capacity. In fact, the industry is threatened with a shortage of unfinished steel, specifications on billet and sheet-bar contracts being very heavy. Finishing capacity is in excess of steel-making capacity. In plates, shapes, sheets and tinplates operations are close to the actual capacity of the mills. In rails, wire and pipe there is considerable slack, but in all lines there is heavier production than in the closing months of last year.

Minimum prices are 1.10c. on bars and 1.15c. on plates and shapes, and these prices are really exceptional, the majority of producers quoting 1.15c. on bars and 1.20c. on plates and shapes.

Pig Iron—The Republic Iron & Steel Co. has bought 40,000 tons of bessemer pig iron at $14.25, Brier Hill furnace, and 40,000 tons of basic pig iron at $13, Struthers furnace, for delivery over the next few months. The American Steel Foundries has bought 10,000 tons of basic for second-quarter delivery at Alliance at about $13, Valley furnace, while another consumer has bought 10,000 tons of bessemer at $14.25, Valley furnace. An inquiry for 6000 to 8000 tons of basic for the Colonial Steel Co. has been pending for some time, while this week inquiries appeared for 5000 tons of basic from the Commonwealth Steel Co. at St. Louis and 15,000 tons of the same grade from the Andrews Steel Co. at Newport, Ky. By the active buying of bessemer and basic in the past 30 days the stocks of these grades have been entirely eliminated and the statistical position of merchant pig iron in this district has become very good. The current consumption is not below the current production, and may be somewhat above it, while there is no likelihood of any of the merchant furnaces coming into blast unless they can obtain from 50c. to $1 above the present market. Ore is lower, but the decline from the actual selling prices of last year is small, and the present decline was fully discounted. Coke, on the other hand, is at least $1 a ton higher than the average price done on contracts for this half-year, and the idle furnaces do not have contracts. We quote: Bessemer, $14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; gray forge, $12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg, and for early delivery, second-half deliveries being quoted at higher figures.

Ferromanganese—Spot metal continues scarce and fancy prices are paid for small spot lots, $42@45, Baltimore; but the regular market remains at $41, Baltimore.

Steel—The market is higher, as very little unfinished steel is available. For many weeks the leading local producer has been entirely out of the market, while other producers have been getting filled up. Offerings of steel made in the Pittsburg district are extremely limited, and the sellers in Youngstown are quoting higher prices. We quote billets at $19.50@20 and sheet bars at $20@20.50, bessemer or openhearth, f.o.b. maker's mill, Pittsburg or Youngstown. Rods are $25, Pittsburg.

Sheets—The sheet market is gradually stiffening, owing to mills becoming well sold up. For weeks some important producers have been running full and have been practically out of the market, prices being made by a few mills which were still anxious for business. The market is now quotable at 1.85c. for black and 2.85c. for galvanized, as minimum prices, since these figures are very rarely shaded, and then only in limited areas, while actual sales of fair tonnages have been made at 1.90c. for black and 2.90c. for galvanized. About three weeks ago the leading interest advanced its minimum on galvanized to 2.90c., and while it lost some business thereby it did not lose as much as expected. Later it advanced its minimum on black to 1.85c. It is not unlikely it will make further advances in both before next report. We quote: Blue annealed, 10 gage, 1.35@1.40c.; black, 28 gage, 1.85@1.90c.; gal-

vanized, 2.85@2.90c.; painted corrugated, $1.35 per square; galvanized, $2.50 per square.

St. Louis

April 9—The demand for pig iron seems to be slowly improving and the volume of inquiries is quite large. Most of the business is for small lots ranging from 100 to 500 tons. While the coal strike is not quite settled as yet there is no doubt that Illinois will be working again within 30 days and possibly before. Consumers are much relieved at the turn the coal situation has taken which will undoubtedly result in considerable more activity along industrial lines another month. The demand for finished products and railroad supplies is quite good.

Southern No. 2 foundry iron is being quoted at $10.50@10.75 Birmingham $14.25@14.50 St. Louis for both immediate and third-quarter delivery. Northern No. 2 iron is quoted at $14.25@14.50 per ton.

Coke is in good demand, though a trifle easier than last month, as consumers were then trying to accumulate a stock on hand on account of anticipated strikes. Good foundry coke is quoted at $5.10@5.20 per ton St. Louis.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for two months ended Feb. 29, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes
Exports	$36,298,183	$40,253,484	I. $3,424,301
Imports	5,020,633	4,292,031	D. 728,602
Excess, exp.	$31,808,550	$35,961,453	I. $4,152,903

Increase in exports, 9.3%; decrease in imports, 14.5%. The leading articles of iron and steel were, in long tons:

	Exports 1911	Exports 1912	Imports 1911	Imports 1912
Pig iron	25,737	27,450	30,354	18,638
Scrap	8,877	17,413	2,676	1,663
Billets, blooms, etc.	35,284	28,202	5,150	2,905
Bars	21,514	25,245	5,542	3,557
Rails	63,007	53,707	.....	814
Sheets and plates	43,812	71,386	426	404
Structural steel	30,374	35,132	.....	131
Wire-rods	1,661	6,050	3,164	2,817
Wire	28,042	32,672	.....	.....
Nails and spikes	8,373	17,681	.....	.....
Tinplates	4,070	9,004	6,550	511
Pipe and fittings	14,999	22,263	.....	.....

Imports of wire are not reported in quantities; values were $205,479 in 1911 and $165,463 in 1912. Exports of mining machinery in 1912 were valued at $1,009,222, a decrease of $195,597 from last year.

Iron Ore Trade

Sales of Lake iron ore continue to be made at the prices noted last week: Old Range bessemer ores, base 55% iron and used 0.45 phosphorus, $3.75; Mesabi bessemers, $3.50; Old Range nonbessemers, base 51.5% iron, $3.05; Mesabi nonbessemers, $2.85; all f.o.b. dock, Lake Erie ports.

A strong effort is being made to place ores with Eastern furnaces, and it is reported that Old Range nonbessemers have been offered as low as $2.80, which would work out about 8.3c. per unit, delivered. It is probable that some ore can be placed. The sale of Lake ore in the East is helped by the recent sharp increase in ocean freight rates, which will discourage the import of Spanish and Swedish ores. Not only have rates advanced, but charters are hard to get.

Metal Markets

New York, April 10—The metal markets generally are strong, but less excited.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January	110	111	July	112	.....
February	115	109	August	117	.....
March	112	111	September	111	.....
April	114	.....	October	112	.....
May	118	.....	November	111	.....
June	115	.....	December	110	.....

Year 1909, 115; 1910, 115; 1911, 112.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Feb. 1912	$ 10,589,295	$ 2,937,274	Exp. $7,652,021
" 1911	424,733	5,805,844	Imp. 5,381,111
Year 1912	12,504,497	8,078,517	Exp. 4,425,980
" 1911	1,348,409	15,346,674	Imp. 13,998,265
Silver			
Feb. 1912	5,121,776	3,780,477	Exp. 1,341,329
" 1911	4,453,171	3,897,946	Exp. 555,225
Year 1912	11,149,681	8,138,486	Exp. 3,011,195
" 1911	10,104,247	7,449,372	Exp. 2,654,875

Exports from the port of New York, week ended Apr. 6: Gold, $365,325, chiefly to Argentina; silver, $1,175,739, to London and Paris. Imports: Gold, $473,993; silver, $356,817, from Mexico, Central and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was rather a heavy demand for India and some gold was also taken for Berlin. In New York, some gold is still going to Argentina.

Iridium—Prices are steady at $64 per oz. for pure metal.

Platinum—The market is quiet, with no change in prices. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Mar. 28, that the market and the prices remain generally unchanged. The large producers are doing little business. The small producers and the starateli sell their platinum to local speculators. After the Easter holidays the offer of platinum by these producers will increase and this will cause a fall of prices; but this will be only local and temporary. The quotations are: in St. Petersburg, 38,100 rubles per pood for crude metal, 83 per cent. platinum; at Ekaterinburg, 9.30 rubles per zolotnik for the same grade—equal to $37.34 and $34.97 per oz., respectively.

Silver—The market continues steady without any new feature. The Indian bazaars are at present in the market. The future course depends much on hte action of China and the bearing of the new loans, if they are negotiated.

SILVER AND STERLING EXCHANGE

Apr.	4	5	6	8	9	10
New York	58⅞	58¾	58¾	58¾	58¾	58⅞
London	27½	....	27⅛	....	26⅞	26⅞
Sterling Ex.	4.8695	4.8695	4.8680	4.8670	4.8690	4.8690

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Mar. 28, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India	£2,408,300	£1,698,300	D. £710,000
China	702,800	415,000	D. 287,800
Total	£3,111,100	£2,113,300	D. £ 997,800

India Council bills in London averaged 16.05d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Apr.	Copper Lake, Cts. per lb.	Copper Electrolytic, Cts. per lb.	Tin Cts. per lb.	Lead New York, Cts. per lb.	Lead St. Louis, Cts. per lb.	Zinc New York, Cts. per lb.	Zinc St. Louis, Cts. per lb.
4	15⅞ @16	15.70 @15.80	43⅛	4.20	@4.12½ 4.15	6.45 @6.55	6.30 @6.40
5	15⅞ @16	15.70 @15.80	43⅛	4.20	4.12½ @4.15	6.45 @6.55	6.30 @6.40
6	15⅞ @16	15.70 @15.80	43⅛	4.20	4.12½ @4.15	6.45 @6.55	6.30 @6.40
8	15⅞ @16	15.70 @15.80	43⅛	4.20	4.12½ @4.15	6.50 @6.70	6.35 @6.55
9	15⅞ @16	15.70 @15.80	43⅛	4.20	4.12½ @4.15	6.50 @6.70	6.35 @6.55
10	15⅞ @16	15.70 @15.80	43	4.20	4.12½ @4.15	6.50 @6.70	6.35 @6.55

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The uncertainty following the wabbling of the London standard market toward the close of the week for which we last reported became dispelled on Apr. 4 when the domestic market settled upon the basis of about 15⅞@16c., delivered, usual terms, the lower figure applying on domestic business and the higher on shipments to Europe, whither the freight rates are now higher than ordinarily. Sales of electrolytic aggre-

LONDON

Apr.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
4	70	70⅞	75	197	192¾	16 5/16	25⅜
5	....	....	....	.....	.....	....	....
6	.....	.....	.....	.....	.....	.....	.....
8	....	....	....	.....	.....	....	....
9	70½	71⅜	75¼	198⅜	194¾	16 5/16	25⅜
10	69 5/16	70 5/16	74¼	197	194½	16 5/16	25⅜

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

gating some millions of pounds were made to Europe, chiefly to speculators on Apr. 4 and Apr. 9, the business during the intervening period being insignificant owing to the holidays. The demand from manufacturers, both home and abroad, has been but small and at the close the market is dull. Electrolytic is offered domestically at 15⅞c., delivered, usual terms. Lake copper seems to be available at 16c. from all quarters, and some sales at that price, with and without discounts, have been reported, but there has been no activity in this market. It is natural there should be a lull in the buying after the heavy purchases which were made during March. Producers are now well booked ahead, and no pressure to sell has been occasioned by the smaller business that has presented itself. Consumption both in this country and in Europe continues excellent. The market closes with Lake copper at 15⅞@16c., and electrolytic copper in cakes, wirebars and ingots at 15.70@15.80c. Casting copper is quoted nominally at 15½@15⅝c. as the average for the week.

The London market for standard copper was closed most of the week. On Thursday, Apr. 4, spot sold at £70, and three months at £70 17s. 6d. There was no exchange until Tuesday, Apr. 9, when the market opened 10s. higher. On Wednesday, under pressure of realization by speculative holders, the market declined over £1, and closes at £69 6s. 3d. for spot, and £70 3s. 9d. for three months.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Cop per wire is 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 7434 long tons. Our special correspondent gives the exports from Baltimore at 1094 tons.

Tin—The prolonged holiday in Europe interfered with business both here and abroad. The end of the coal strike in England induced the large tinplate manufacturers of Wales to make heavier purchases, and a strong and advancing market was the consequence. Business on the London Metal Exchange is increasing in volume.

In this market, a fair business was done in future tin among dealers at prices somewhat below the foreign levels. The close in both markets is rather easier, at £197 for spot, and £194 10s. for three months, and at 43c. for April tin, at New York.

Lead—The market is quiet. New York is quoted at 4.20c., and St. Louis is slightly easier at 4.12½@4.15 cents.

The London market for Spanish lead is quoted at £16 3s. 9d. and English at 2s. 6d. higher.

Spelter—Some tonnages have moved during the last week, although the market cannot be characterized as otherwise than dull. The business has been for April, May and June deliveries, about equally divided, at prices from 6.55@6.35c., St. Louis, realized during the latter part of the week. There has been irregularity among the transactions reported by various sellers for the same deliveries, indicating that buyers have not been "shopping." The recent recession in the European price enables Kansas smelters to pay the duty on imported ore, offer the spelter from it at about 6.45c., and still realize as much as by exportation, but the increased supply available in this way is not large. However, the tension in the spelter market is apparently less than it was a little while ago. The market closes at 6.35@6.55c. East St. Louis, according to delivery, and 6.50@6.70c. New York.

The London market is slightly higher, good ordinaries being quoted at £25 10s., and specials at £25 15s. per ton.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York.

Other Metals

Aluminum—Business is on a fair scale and prices are firm and unchanged. Quotations are 20@20½c. per lb. for No. 1 ingots, New York. The foreign market is reported steady.

Antimony—Business remains fair and prices are unchanged. The quotation for Cookson's is 8c. per lb., and for Hallett's and U. S. 7¾c.; while 6⅞@7c. is named for Hungarian, Chinese and other outside brands.

Quicksilver—Demand is good, but there is still some range in prices. New York quotations are $42@44 per flask of 75 lb., with the usual advances for small quantities. San Francisco is $42.50 for domestic orders and $40 for export. The London price is £8 12s. 6d. per flask, with £8 7s. 6d. quoted from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., April 6—The highest price paid this week for zinc ore was $53.50; the base price, 60% zinc, was $51@53. The highest price paid for lead ore was $54; the base price, 80% lead, was $53 per ton.

SHIPMENTS, WEEK ENDED APR. 6

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena	793,200	.....	.....
Mineral Point	756,200	.....	.....
Shullsburg	368,600	.....	.....
Hazel Green	345,600	.....	.....
Benton	222,800	65,720	621,500
Harker	199,760	.....	.....
Livingston	185,000	.....	.....
Platteville	169,300	.....	100,000
Cuba City	106,400	.....	154,800
Rewey	79,000	.....	.....
Linden	65,010	.....	60,000
Highland	31,600	.....	.....
Total	3,322,470	65,720	936,300
Year to date	53,409,640	1,447,330	5,647,190

Shipped during week to separating plants, 1,371,435 lb. zinc ore.

Joplin, Mo., Apr. 6—The high price of zinc sulphide ore was $59.50, the base price, per ton of 60% zinc, $50@57. Zinc silicate sold on a base of $25@28 per ton of 40% zinc. Average price, all grades of zinc, $50.42. Lead sold as high as $57 per ton, with a lower tendency at the week-end, $55 being the best offer . The average price, all grades lead, is $55.02 per ton.

SHIPMENTS, WEEK ENDED APR. 6

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,454,690	.....	1,193,350	$148,637
Joplin	1,915,970	.....	246,170	49,040
Galena	762,640	.....	127,260	22,630
Duenweg	629,010	264,180	33,480	21,234
Alba-Neck	648,460	.....	.....	17,508
Oronogo	609,100	.....	78,750	14,955
Cave Springs	423,920	.....	33,720	12,800
Carl Junction	429,920	.....	.....	12,465
Springfield	398,500	.....	35,490	11,510
Miami	327,200	.....	117,730	10,430
Jackson	389,830	.....	9,780	10 400
Granby	214,970	270,850	10,690	8,350
Carthage	191,500	.....	.....	4,979
Spurgeon	62,310	128,300	6,010	3,645
Aurora	.....	75,360	35,000	1,990
Badger	23,000	.....	4,010	725
Totals	11,481,520	738,690	1,932.040	$351,298
14 weeks	139.398.530	8,108,500	22,697,600	$4,004,646

Blende val. the week, $297,311; 14 weeks, $3,271,407
Calamine, the week, 10,817; 14 weeks, 115,002
Lead value, the week, 53,170; 14 weeks, 628,237

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43 31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	.....	37.47	.....	56 37	.....
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56 49	.....
July	40 75	.....	38.36	.....	58 81	.....
August	42 50	.....	41 28	.....	60 74	.....
September	42 63	.....	41 29	.....	59 33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57 19	.....
December	44.13	.....	40.76	.....	62 03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

This has been the first wholly good week of this year for outputting and the roads are permitting some of the outlying stock, purchased several weeks ago, to be hauled to the railroads for loading out. There is little, if any, ore on top of the ground unsold, and advance purchases cover almost a full week's output of ore yet unmined. It has been years since a similar condition was known, if it ever was purchased so far ahead of the output. Approximately 3500 tons are scattered around in small lots where loading has been out of the question, but it is all sold.

Chemicals

New York, Apr. 10—The general markets are steady and show little change for the week.

Copper Sulphate—Business is good and prices are unchanged. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Spot supplies are still scarce, while demand is good. For white arsenic $3.75@4 per 100 lb. is named for spot; while $3.50@3.75 per 100 lb. is asked for futures.

Nitrate of Soda—The market is active and prices are again firmer, 2,40c. per lb. being quoted for spot nitrate and 2.35@2.40c. for futures.

Messrs. Mortimer & Co., New York, report the position of nitrate in the United States, on Apr. 1, as follows, in long tons:

	1911	1912	Changes
Stocks, Jan. 1	12,790	9,000	D. 3,790
Imports, 3 mos	158,422	82,100	D. 76,322
Supplies	171,212	91,100	D. 80,112
Deliveries, 3 mos	154,712	87,600	D. 67,112
Stocks, Apr. 1	16,500	3,500	D. 13,000
Afloat for U. S.	100,000	100,000	.....

Quantities afloat include all cargoes due to arrive at United States ports before July 15 next.

Petroleum

The monthly report of the *Oil City Derrick* gives the number of new oil wells completed in March as follows: Pennsylvania and West Virginia, 313; Lima-Indiana, 31; Kentucky, 19; Illinois, 54; Kansas-Oklahoma, 408; Texas-Louisiana, 96; total, 912. In all the divisions there were 921 wells completed, 80 more than in February. The new production was 44,902 bbl., an increase from the February report of 1377 bbl. There were 165 failures among the completed wells, and 78 gas wells, a total of 243, leaving 678 oil producers. On the last day of March there were 503 rigs up and 1088 drilling wells, a total of 1591. This was an increase of 53 in rigs and 132 of wells drilling.

California production is reported at 6,893,432 bbl. in February.

Mining Stocks

New York, Apr. 10—On Apr. 4, the Exchange was still active, but with an irregular movement of prices. Amalgamated Copper advanced and Steel common was strong. On the Curb, dealing in mining stocks was only moderate. Copper stocks were most in demand, generally at small advances.

Apr. 5 was a holiday, both on the Exchange and the Curb. Apr. 6, the Exchange was generally active. Steel common was especially strong. On the Curb, Lehigh Valley Coal Sales Co. and the Standard Oil stocks advanced. Other mining stocks were firm.

April 8 the markets were active, with large sales, and prices a little irregular, but generally strong. On the Curb mining stocks were active and advanced, but toward the close there were heavy profit-taking sales, and some consequent reaction.

April 9 the liquidation, which began the previous day, continued for a time, but the market then firmed up and closed strong, remaining so on Apr. 10, with continued advances in copper and steel stocks. On the Curb, business was active on both days, especially for the copper stocks, which were in good demand. Cobalt stocks were also firm.

At auction in New York, Apr. 4, sales were made of 200 shares Little Chief Mining Co., at $2 for the lot; 500 shares Silver Cliff Mining Co., $1 for the lot; Comstock Tunnel Co., 2000 shares, 13c. per share; $1000 first-mortgage bonds at 15, and $500 income bonds at 13; 200 shares Silver King Mining Co., $13 for the lot.

Boston, April 9—The copper-share market has gained added momentum during the week, although at the present writing trading has quieted down a bit. Naturally, reactions have occurred but prices hold wonderfully firm considering that many stocks are selling at their highest points in many years, while others are selling at record prices. Among the last named are Mayflower and Old Colony, the former rising $4.50 to $17.75 during the week's time and the latter $3.50 to $1.75 per share.

As in all bull markets much is heard of rich copper being encountered and this was the case in New Arcadian, which is up to $6.12½ on news that rich copper ground has been encountered at a depth of 1075 ft. Per contra, Utah Consolidated took a perpendicular drop of $7.25 to $12.75, with subsequent recovery to above $14. The issue of the annual report brought free selling with the above damage to the stock. A $3 advance in Lawson's Trinity to $9.50 and First National on the Curb to above $4 have been conspicuous features the past few days.

A $5 advance in Butte & Superior shares to $33 is accompanied by rumors

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Jan.	Feb.	March
Alaska shipments	3,701,010	.....	4,987,916
Anaconda	26,350,000	27,450,000	25,900,000
Arizona, Ltd	3,200,000	3,020,000	.....
Copper Queen	6,748,264	6,046,860	7,197,121
Calumet & Ariz	4,544,000	4,452,004	4,652,000
Detroit	1,941,970	2,068,370	2,246,238
East Butte	1,520,000	1,440,000	.....
Mammoth	1,665,319	1,722,954	.....
Mason Valley	600,000	1,100,000	.....
Nevada Con	6,339,228	4,888,790	.....
Old Dominion	2,044,000	2,039,000	.....
Ray	2,475,945	2,140,000	.....
Shannon	1,550,000	1,300,000	1,[illegible],000
South Utah	189,678	283,838	.....
United Verde*	2,000,000	2,250,000	.....
Utah Copper Co	8,156,612	8,612,739	.....
Lake Superior*	17,500,000	19,000,000	.....
Non-rep. mines*	8,400,000	8,000,000	.....
Total production	98,896,026	.....	.....
Imports, bars, etc.	31,790,590	18,976,513	.....
Total blister	130,686,616	.....	.....
Imp. in ore & matte	8,340,740	10,432,438	.....
Total	139,027,356	.....	.....
Miami	2,235,647	2,475,996	.....
Brit. Col. Cos.:			
British Col. Copper	538,190	860,003	.....
Granby	1,607,558	1,773,496	.....
Mexican Cos.:			
Boleo	2,315,040	2,204,720	2,424,800
Cananea	3,552,000	.....	.....
Moctezuma	2,732,867	2,687,712	2,446,731
Other Foreign:			
Cape Cop., S. Africa	784,000	786,440	.....
Kyshtim, Russia	.....	.....	.....
Spassky, Russia	795,200	649,600	.....
Famatina, Argen	172,480	.....	.....
Tilt Cove, Newf'd	153,257	109,059	.....
Exports from:			
Chile	8,064,000	6,720,000	.....
Australia	7,056,000	7,164,000	.....
Arrivals in Europe†	13,144,320	10,868,680	.....

Figures are reports received from companies, unless otherwise stated. Bolco copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
III, 1911	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167 904
II	116,035,809	56,228,368	63.148,096
III	125,694,601	67,487,466	58,779,566

VISIBLE STOCKS

	United States	Europe	Total
IV, 1911	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89.454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

of an increase in the stock and rights to ensue. Lake Copper has been less active although steady in price.

The good feeling has also spread to the Curb, where everything is strong and active.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	.....	$0.005
Algomah, Mich	Jan. 22	.....	1.00
Belcher, Nev	Apr. 8	Apr. 30	0.10
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6	.....	0.01
Boston Ely, Nev	Jan. 18	.....	0.50
Bullion, Nev	Apr. 30	May 20	0.05
Cedar-Talisman, Utah	Apr. 20	.....	0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 15	0.20
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Ely Con., Nev	.....	.....	0.05
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	.....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	.....	0.01½
Leonora, Utah	Apr. 15	Apr. 30	0.0125
Lower Mammoth, Utah	Mar. 16	.....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	.....	1.005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	.....	0.10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz	Jan. 15	.....	1.00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Wabash, Utah	Mar. 19	Apr. 10	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	.....	24.483	24.595	.....
May	53.870	53.308	.....	24.797	24.583	.....
June	53.462	53.043	.....	24.651	24.486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	.....	12.275	.....	54.034	.....
May	11.989	.....	12.214	.....	54.313	.....
June	12.385	.....	12.611	.....	56.365	.....
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42 529	July	42 400	.....
February	41.614	42.962	August	43 319	.....
March	40.157	42.577	September	39 755	.....
April	42.185	.....	October	41.185	.....
May	43.115	.....	November	43.125	.....
June	44.606	.....	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	.....	4.262	.....	12.889	.....
May	4.373	.....	4.223	.....	12.984	.....
June	4.435	.....	4.292	.....	13.260	.....
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	.....	5.249	.....	23.743	.....
May	5.348	.....	5.198	.....	24.375	.....
June	5.520	.....	5.370	.....	24.612	.....
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26.801	.....
September	5 869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	.....	14.65	.....	15.00	.....
May	15.90	.....	14.30	.....	14.72	.....
June	15.90	.....	14.06	.....	14.56	.....
July	15.90	.....	14.03	.....	14.53	.....
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Apr. 9

Name of Comp.	Bid.
Acacia	.05½
Cripple Cr'k Con.	.01½
C. K. & N.	.17⅛
Doctor Jack Pot	.06
Elkton Con	.62½
El Paso	.78½
Findlay	.04½
Gold Dollar	.14½
Gold Sovereign	.02½
Isabella	.12⅜
Jack Pot	.06
Jennie Sample	.04½
Lexington	.01
Moon Anchor	.01
Old Gold	.03½
Mary McKinney	.79½
Pharmacist	.01½
Portland	.88
Vindicator	.73⅞
Work	.01

SALT LAKE Apr. 9

Name of Comp.	Bid.
Beck Tunnel	.16½
Black Jack	.21½
Carisa	‡.15
Cedar Talisman	.02
Colorado Mining	.30
Columbus Con	.22
Daly-Judge	5.95
Grand Central	.65
Iron Blossom	1.27½
Little Bell	.39
Lower Mammoth	.04½
Mason Valley	12.50
May Day	.15
Nevada Hills	2.40
New York	‡.05½
Prince Con	1.20
Silver King Coal'n	1.70
Sioux Con	‡.04
Uncle Sam	.20
Yankee	‡.15

TORONTO Apr. 9

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7.50	Hollinger	11.90
Hudson Bay	‡70.00	Imperial	.06
Temiskaming	.39	Pearl Lake	.20
Wettlaufer-Lor	.63	Porcu. Gold	.43
Apex	‡.04	Porcu. Tisdale	‡.03
Central	‡5.00	Preston E. D.	.11
Crown Chartered	‡.28	Rea	.55
Dobie	‡.45	Standard	‡.13
Dome Exten	.68	Swastika	.23
Foley O'Brien	.30	West Dome	‡.40

SAN FRANCISCO Apr. 9

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.09	Belmont	10.15
Belcher	.85	Jim Butler	.72
Best & Belcher	.19	MacNamara	.25
Caledonia	4.10	Midway	.37
Challenge Con	.31	Mont.-Tonopah	3.42½
Chollar	.13	North Star	.31
Confidence	1.00	West End Con	2.12½
Con. Virginia	.73	Atlanta	.30
Crown Point	.80	Booth	.10
Gould & Curry	.08	C.O.D. Con	.09
Hale & Norcross	.40	Comb. Frac	.18
Mexican	3.45	Jumbo Extension	.43
Occidental	.65	Pitts.-Silver Peak	1.42½
Ophir	1.37½	Silver Pick	.10
Overman	2.55	St. Ives	.30
Potosi	.10	Tramp Con	.01
Savage	.31	Argonaut	2.00
Sierra Nevada	.44	Bunker Hill	‡5.50
Union Con	1.25	Cent. Eureka	.28
Yellow Jacket	1.30	So. Eureka	‡5.00

N. Y. EXCH. Apr. 9

Name of Comp.	Clg.
Amalgamated	83
Am. Agri. Chem	61
Am.Sm.&Ref.,com	87⅞
Am.Sm. & Ref., pf.	107⅛
Am.Sm. Sec., pf. B	87
Anaconda	43⅞
Batopilas Min	2½
BethlehemSteelpf	63⅞
Chino	29
Federal M. &S., pf.	‡43
Goldfield Con	4¼
GreatNor.,ore,,ctf.	42½
Homestake	94
Miami Copper	26⅝
Nat'nalLead,com.	58⅝
National Lead, pf.	109
Nev. Consol	20¼
Pittsburg Coal, pf.	85
Ray Con	20
RepublicI&S,com.	24⅝
Republic I & S, pf.	79¾
SlossSheffi'd,com.	48¾
Sloss Sheffield, pf.	‡100
Tennessee Copper	41¾
Utah Copper	65
U. S. Steel, com	72⅝
U. S. Steel, pf.	113
Va. Car. Chem	54½

N. Y. CURB Apr. 9

Name of Comp.	Clg.
Barnes King	.25
Beaver Con	.45
Braden Copper	5⅝
B. C. Copper	5⅜
Buffalo Mines	‡1¾
Butte & Vipond	‡.53
Caledonia	.70
Con. Ariz. Sm	⅝
Davis-Daly	1⅜
Diam'field-Daisy	14
Ely Con	1/16
Florence	.81
Giroux	6¼
Gold Hill Con	¼
Greene Cananea	9⅛
Greenwater	.09
Guggen. Exp	223
Inspiration Con	20⅜
Internat. S. & R.	‡128
LaGrange Placer	‡2⅞
Kerr Lake	2⅛
La Rose	3¾
McKinley-Dar-Sa	1⅝
Min. Co. of A. new	3½
Nev. Utah M. & S.	1/16
Nipissing Mines	8⅛
Ohio Copper	1½
Pacific Sm. & M	⅛
Precious Metals	‡1⅜
Ray Central	2½
Red Warrior	‡1½
South Utah M. & S.	1¼
Standard Oil (Old)	880
Stand'd Oil of N.J.	398
Stand'd Oil Subs.	508
Stewart	1¼
Tonopah	7⅞
Tonopah Ex	2
Tri-Bullion	1/16
Tularosa	1
United Cop., pfd.	15
Yukon Gold	3¾

LONDON Apr. 10

Name of Com.	Clg.
Camp Bird	£1 10s 6d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 15 0
Mexico Mines	6 15 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 1 3

BOSTON EXCH. Apr. 9

Name of Comp.	Clg.
Adventure	5¾
Algomah	6¾
Allouez	45
Am. Zinc	28
Ariz. Com., ctfs.	6
Bonanza	.51
Boston & Corbin	7⅜
Butte & Balak	4½
Calumet & Ariz	74¼
Calumet & Hecla	493
Centennial	21½
Con. Mercur	.07
Copper Range	63½
Daly West	7
East Butte	14⅞
Franklin	15¼
Granby	47
Hancock	33½
Hedley Gold	‡18
Helvetia	1⅛
Indiana	16
Island Cr'k, com.	‡43
Island Cr'k, pfd.	86½
Isle Royale	27½
Keweenaw	2
Lake	46¾
La Salle	6
Mass	7⅛
Michigan	3¼
Mohawk	64
New Arcadian	6
New Idria Quick	‡67⅛
North Butte	33
North Lake	7
Ojibway	5⅛
Old Dominion	51¼
Osceola	118
Quincy	87
Shannon	14⅛
Shattuck-Ariz	20½
Superior	33¼
Superior & Bost.	2½
Tamarack	30
Trinity	9¾
Tuolumne	3⅞
Union Mines	‡2¼
U. S. Smelting	38¾
U. S. Smelt'g, pf.	48¾
Utah Apex	3
Utah Con	14⅝
Victoria	5¼
Winona	6¾
Wolverine	112
Wyandot	2¾

BOSTON CURB Apr. 9

Name of Comp.	Last
Ahmeek	285
Bingham Mines	3½
Boston Ely	2
Boswycocolo	.09½
Butte Central	7⅞
Cactus	.16
Calaveras	3.00
Chief Cons	1⅛
Corbin	2½
Cortez	1
Crown Reserve	3½
First Nat. Cop.	3⅛
Majestic	.71
Mazatan	‡¾
Moneta Porc	.19
Nevada-Douglas	4⅞
New Baltic	4⅜
Oneco	3½
Raven Copper	.44
Rhode Island Coal	.05
San Antonio	‡3
S. W. Miami	8¾
South Lake	6½
Trethewey	.65
United Verde Ext.	.45
Vulture	‡5.00

‡Last quotation.